FOR·THE·INCREASE·AND·DIFFVSION·OF·KNOWLEDGE·AMONG·MEN·
PER
ORBEM
·SMITHSONIAN·INSTITVTION·
·WASHINGTON·1846·

SHOUT
SHARE
IT

SMITHSONIAN INSTITUTION
UNITED STATES NATIONAL MUSEUM
Bulletin 100
VOLUME 6

CONTRIBUTIONS TO THE BIOLOGY OF THE PHILIPPINE ARCHIPELAGO AND ADJACENT REGIONS

PAPERS ON PHILIPPINE DIATOMS, ANNELIDS, HYDROIDS, ECHINOIDS, AND MOLLUSKS

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1939

ADVERTISEMENT

The scientific publications of the National Museum include two series, known, respectively, as *Proceedings* and *Bulletin.*

The *Proceedings* series, begun in 1878, is intended primarily as a medium for the publication of original papers, based on the collections of the National Museum, that set forth newly acquired facts in biology, anthropology, and geology, with descriptions of new forms and revisions of limited groups. Copies of each paper, in pamphlet form, are distributed as published to libraries and scientific organizations and to specialists and others interested in the different subjects. The dates at which these separate papers are published are recorded in the table of contents of each of the volumes.

The series of *Bulletins,* the first of which was issued in 1875, contains separate publications comprising monographs of large zoological groups and other general systematic treatises (occasionally in several volumes), faunal works, reports of expeditions, catalogs of type specimens, special collections, and other material of similar nature. The majority of the volumes are octavo in size, but a quarto size has been adopted in a few instances in which large plates were regarded as indispensable. In the *Bulletin* series appear volumes under the heading *Contributions from the United States National Herbarium,* in octavo form, published by the National Museum since 1902, which contain papers relating to the botanical collections of the Museum.

The present work forms No. 100, Volume 6, of the *Bulletin* series.

Alexander Wetmore,
Assistant Secretary, Smithsonian Institution.

Washington, D. C., *March 31, 1939.*

CONTENTS

Page

Part 1. Marine diatoms of the Philippine Islands. By Albert Mann. Published June 27, 1925 ---- 1
- Introduction ---- 1
- Similarity of Campeche Bay and Philippine Islands diatom floras ---- 5
- List of Campeche Bay–Philippine diatoms ---- 7
- Nomenclature ---- 9
- Genera and species, with systematic discussions ---- 10

Part 2. Additions to the polychaetous annelids collected by the United States Fisheries steamer *Albatross*, 1907–1910, including one new genus and three new species. By Aaron L. Treadwell. Published November 20, 1926 ---- 183

Part 3. Report on the Hydroida collected by the United States Fisheries steamer *Albatross* in the Philippine region, 1907–1910. By Charles C. Nutting. Published April 27, 1927 ---- 195
- Introduction ---- 195
- Systematic review of the hydroids ---- 198
- Bibliography ---- 239

Part 4. Report on the Echinoidea collected by the United States Fisheries steamer *Albatross* during the Philippine expedition, 1907–1910. Part 1. The Cidaridae. By Theodor Mortensen. Published September 10, 1927 ---- 243

Part 5. Four new species of polychaetous annelids collected by the United States Fisheries steamer *Albatross* during the Philippine expedition of 1907–1910. By Aaron L. Treadwell. Published October 31, 1931 ---- 313

Part 6. The Philippine land mollusks of the genus *Opisthoporus*. By Paul Bartsch. Published June 18, 1932 ---- 323

Part 7. The Philippine land mollusks *Cochlostyla rufogaster* and *Obba marmorata* and their races. By Paul Bartsch. Published August 20, 1932 ---- 329
- *Cochlostyla rufogaster* and its races ---- 329
- *Obba marmorata* and its races ---- 337

Part 8. The land shells of the genus *Obba* from Mindoro Province, Philippine Islands. By Paul Bartsch. Published April 1, 1933 ---- 343

Part 9. The tree snails of the genus *Cochlostyla* of Mindoro Province, Philippine Islands. By Paul Bartsch. Published February 26, 1938 ---- 373

Index ---- 535

ILLUSTRATIONS

PLATES

MARINE DIATOMS OF THE PHILIPPINE ISLANDS

By Albert Mann

Page

1–39. Diatoms of the Philippine Islands 182

REPORT ON THE HYDROIDA COLLECTED BY THE UNITED STATES FISHERIES STEAMER "ALBATROSS" IN THE PHILIPPINE REGION, 1907–1910

By Charles C. Nutting

40. New species of *Stegopoma* and *Hebella* 242
41. New species of *Acryptolaria*, *Zygophylax*, and *Dictyocladium* 242
42. Gonosomes of *Sertularella* and *Diphasia* 242
43. New species of *Diphasia* and *Plumularia* 242
44. New species of *Plumularia* and *Antennella* 242
45. Gonosome of *Acanthella* and a new species of *Antennopsis* 242
46. New genus *Stechowia* and new species of *Aglaophenia* 242
47. New species of *Thecocarpus* and *Halicornaria* 242

REPORT ON THE ECHINOIDEA COLLECTED BY THE UNITED STATES FISHERIES STEAMER "ALBATROSS" DURING THE PHILIPPINE EXPEDITION, 1907–1910. PART 1. THE CIDARIDAE

By Theodor Mortensen

48–80. Echinoidea collected by the *Albatross* 312

THE PHILIPPINE LAND MOLLUSKS OF THE GENUS OPISTHOPORUS

By Paul Bartsch

81. The Philippine species of *Opisthoporus* 327
82. Relief map showing the distribution of *Opisthoporus* in the Philippines 327

THE PHILIPPINE LAND MOLLUSKS COCHLOSTYLA RUFOGASTER AND OBBA MARMORATA AND THEIR RACES

By Paul Bartsch

83–85. Races of *Cochlostyla rufogaster* 342
86. *Obba marmorata* and its races 342

THE LAND SHELLS OF THE GENUS OBBA FROM MINDORO PROVINCE, PHILIPPINE ISLANDS

By Paul Bartsch

87. Relief map of Mindoro Province, showing localities from which specimens of *Obba* were obtained 343
88–89. Subspecies of *Obba gallinula* and *O. listeri* 371
90. Forms of four species of *Obba* 371
91–93. Subspecies of *Obba mesai* and *O. planulata* 371

The Tree Snails of the Genus Cochlostyla of Mindoro Province, Philippine Islands

By Paul Bartsch

Page
94–115. Species and subspecies of *Cochlostyla* 533
116–118. Maps of Mindoro Province, showing localities where collections were made 533
119. Map of the islands northwest of Mindoro 533
120. Map of the islands southeast of Mindoro 533

TEXT FIGURES

Additions to the Polychaetous Annelids Collected by the United States Fisheries Steamer "Albatross," 1907–1910, Including One New Genus and Three New Species

By Aaron L. Treadwell

1–12. *Laetmonice nitida* 187
13–20. *Nereis masalacensis* 191

Report on the Echinoidea Collected by the United States Fisheries Steamer "Albatross" during the Philippine Expedition, 1907–1910. Part 1. The Cidaridae

By Theodor Mortensen

1. Part of ambulacrum of *Histocidaris magnifica* 246
2. Part of apical system of *Histocidaris magnifica* 246
3. Spicules from tube feet of *Histocidaris magnifica* 247
4. Part of ambulacrum of *Histocidaris acutispina* and of *Histocidaris* sp 248
5. Apical system of *Histocidaris acutispina* 249
6. Peristome of young specimen of *Histocidaris elegans* 252
7. Apical system of young *Histocidaris elegans* 253
8. Apical system of *Histocidaris* sp 255
9. Part of apical system of *Goniocidaris* (*Discocidaris*) *peltata* 262
10. Apical system of *Goniocidaris* (*Cyrtocidaris*) *tenuispina* 266
11. Part of transverse section of primary spine of *Goniocidaris* (*Cyrtocidaris*) *tenuispina* 268
12. Apical system of *Goniocidaris* (*Cyrtocidaris*) *tenuispina tuberculata* 270
13. Part of apical system of *Goniocidaris* (*Cyrtocidaris*) *tenuispina major* 271
14. Apical system of *Rhopalocidaris hirsutispina viridis* 274
15. Part of apical system of *Schizocidaris serrata* 278
16. Details of hair-covering of primary spines of *Schizocidaris serrata* 279
17. Part of apical system of *Schizocidaris fasciata* 281
18. Part of apical system of *Psilocidaris echinulata* 284
19. Apical system of *Stylocidaris effluens* 290
20. Hairs from the primary spines of *Stylocidaris reini* 294
21. Apical system of *Stylocidaris annulosa* 298
22. Part of apical system of *Stereocidaris sceptriferoides lamellata* 305

FOUR NEW SPECIES OF POLYCHAETOUS ANNELIDS COLLECTED BY THE UNITED STATES FISHERIES STEAMER "ALBATROSS" DURING THE PHILIPPINE EXPEDITION OF 1907–1910

By Aaron L. Treadwell

Page
1. *Macellicephala maculosa* 314
2. *Iphionella elongata* 315
3. *Onuphis branchiata* 318
4. *Maldane philippinensis* 320

THE PHILIPPINE LAND MOLLUSKS OF THE GENUS OPISTHOPORUS

By Paul Bartsch

. Operculum of *Opisthoporus* 324

ERRATA

Marine Diatoms of the Philippine Islands

By Albert Mann

Bulletin 100, U. S. National Museum, vol. 6, pt. 1.

P. 15, line 20, for intermediate read indeterminate.

P. 17, under *A. pelagica,* for pl. 23 read pl. 22.

P. 18, under *A. arcuata,* for pl. 25 read pl. 26.

P. 21, for *A. deducta* read *A. diducta.*

P. 22, line 9, for central read ventral.

P. 26, for *A. polygonata* read *A. polyzonata,* and on line 13 for fig. 8 read fig. 18.

P. 37, line 27, for Pantocsek read Tempere.

P. 39, under *B. fimbriata* for pl. 2 read pl. 12.

P. 41, under *B. indica* for pl. 1 read pl. 2, and for *B. inverta* read *B. inversa.*

P. 49, under *C. biangulatus* for Micro. Journ., pl. 4, fig. 1 read Trans. Micro. Soc., pl. 3, fig. 2.

P. 50, under *C. crebrecostatus* for Micro. Journ., 1864 read Trans. Micro. Soc. 1863.

P. 52, under *C. kittonianus* for Micro. Journ., 1850 read Trans. Micro. Soc. 1860.

P. 57, under *C. medusa* for pl. 28 read pl. 29.

P. 58, for *C. foriatus* read *C. foreatus;* also in index to pl. 13, fig. 1.

P. 62, line 22, for *C. robustus* read *C. robusta.*

P. 64, line 26, for Soc. read Sci. and for pl. 10 read pl. 9.

P. 65, under *C. concinnus* for pl. 113 read pl. 114.

P. 74, line 2, for *D. minor* read *D. minus.*

P. 80, for HENSHAWIA read SECALLIA Azpeitia, Diat. Espan., p. 217.

P. 81, for *H. biddulphioides* read *Secallia caballeroi,* Azpeitia, Diat. Espan., pl. 6, figs. 6–7; also in index to pl. 17, figs. 1, 2.

Pl. 82, line 4, for general read genera.

P. 83, line 6, for Grunow read Gran.

P. 93, line 19, for *M. bisereata* read *M. biseriata.*

P. 94, under *N. approximata* omit pl. 4, fig. 10.

P. 97, under *N. brasiliensis* read reference as follows, pl. 6, figs. 20, 21, 23, 25, 31, 33.

P. 101, under *N. durandii* for pl. 28 read pl. 30.

P. 103, for *N. gemmulata* read *N. gemmatula.*

P. 107, last line, for fig. 13 read fig. 63.

P. 109, line 21, for pl. 32, fig. 33 read pl. 14, fig. 15.

P. 111, under *N. multicostata* for figs. 14, 20, read figs. 14–20.

P. 112, line 29, for *ocellae* read *ocelli.*

P. 114, line 7, for double-headed read double-beaded.

P. 117, under *N. puella* for figs. 15–25 read fig. 15.

P. 117, for *N. pulvulenta* read *N. pulverulenta;* also in index to pl. 25, fig. 3.

P. 119, line 7, for pl. 1 read pl. 9.

P. 120, under *N. Separabilis* for 3–5, 7, 10 read figs. 3, 5–7, 10.

P. 126, line 4, omit Micro, Journ., 1880.

P. 142, line 18, for *bilineata* read *bilineatum.*

P. 143, for *Roperia tesselata* read *Roperia tessellata.*

P. 144 bottom, add SECALLIA Azpeitia, *Secallia caballeroi* Azpeitia; see pp. 80–81.

P. 147, line 12, for *cuspidada* read *cuspidata.*

P. 153, line 18, for fig. 177 read fig. 17.

P. 170, lines 19, 23, 24 for *titania* read *titiana.*

P. 171, under *T. radialatum* omit See under *Cestodiscus radiolatus,* and add Schmidt Atlas, pl. 151, figs. 37, 38.

73739—26

MARINE DIATOMS OF THE PHILIPPINE ISLANDS

By Albert Mann

Custodian, Section of Diatoms, United States National Museum

INTRODUCTION

The diatom flora of the Philippine Islands is easily recognizable as a subtropical one. Its forms as a class are large, elaborately ornamented, and therefore very beautiful, and there is no preponderance of the so-called naviculoid forms, elongated diatoms of rather plain design, which are in such large majority in colder waters. This robust and ornate development is due mainly to temperature, the effect of which on the size and ornamentation of the diatoms has been studied by Schumann (Diat. Hoh. Tetra, p. 38), Heribaud (Journ. Roy. Micros. Soc., 1894, p. 491), and others. But abundant nourishment, including organic products in solution, and ample light are also contributory factors in the richness of the diatom flora of these islands.

The locality is also a prolific one, both in the sense of the abundant number of individuals and in that of the great diversity of genera and species inhabiting these waters. It is generally found that colder seas, like the north and south polar regions, while producing rather plain diatoms, are richest in diatom life, as measured by the number of individuals in a given cubic area of water or of bottom material. But even in this particular I have yet to find any specimens of "marine ooze" to equal some collected at Jolo Jolo. In the high percentage of diatoms it contained it reminded me, though it actually surpassed, some material collected by the Shackleton South Polar Expedition at McMurdo Sound. In a paper on Organic Fertility of the North Pacific Ocean (Scripps Institute publications), E. L. Michael says that diatom ooze is very abundant in south polar regions, with isolated patches near the Aleutian and the Galapagos Islands, and he adds: "It is also reported from the Philippine region, an anomalous fact, since diatoms are most abundant in cold latitudes."

The abundance expressed in number of genera and species above noted is, on the other hand, truly subtropical. Just as a prolific production of individuals is generally associated with cold waters, so a prolific diversity of forms is more often met with in warm waters. In the Philippine flora there seems to be in this abundance of genera a fairly even gradation maintained that corresponds to the relative size of each genus. Thus of the large genus, *Biddulphia*, 70 species are recorded here; the enormous genus *Navicula* is represented by 149 species; *Coscinodiscus* is somewhat below its average with 36 species; *Campylodiscus* somewhat above with 47 species; the genus perhaps showing a markedly strong development is *Amphora*, which contributes the relatively large number of 56 species. Of course the many gatherings here included vary greatly in this respect; some are made up principally of round forms, others are decidedly *Amphora* gatherings, etc.

There is here only occasional mention of strictly plankton diatoms, as no plankton gatherings were available for this investigation; and the few species recorded, chiefly *Chaetoceros* and *Rhizoselenia*, were stray individuals found in dredged samples, where a few plankton specimens would necessarily be expected.

Next to the diatoms, the most abundant microorganisms were found to be the radiolaria and the spicules of sponges. As to foraminifera, no estimate of their abundance was possible, because a careful survey of the material was not undertaken until after it had been prepared for diatom study by boiling in acids to remove the organic matter. This process, which leaves unaffected the siliceous diatoms, radiolaria, and spicules, destroys the calcareous foraminifera, together with all the softer organisms, such as copepods, annelids, nematodes, etc. But the preliminary examinations made to determine which samples were diatomaceous enables me to say that foraminifera were present in most of them and in some they were abundant.

I regret to have to record that the exact location of most of the Philippine Island dredgings examined for this paper can not be given. The labels, usually attached to the neck of the bottles of *Albatross* specimens, sometimes included on a slip of paper within the bottle, were in nearly every instance lacking. Those who made the collections can find no explanation for this omission. In one or two bottles fragments of labels were found, but in most cases there was not even a trace of paper fiber discoverable under the microscope. But it is the unfortunate absence of these labels, and not the reason for their absence, that is of importance. The date of collecting, depth, and exact place on the coast where each sample was obtained are therefore wanting. It can however be said that these bottles without labels were unmistakably Philippine Island dredgings, as the letter P was in every case painted upon the cork of the bottle. The nature of the material in most cases, and especially in the samples richest in diatoms, indicated that they were bottom samples taken in shallow bays or harbors rather than along the more exposed parts of the coast.

The richest sample among the many hundreds examined was fortunately known to have come from the neighborhood of Jolo Jolo, Sulu Island. A sort of whirlpool circling of waters coming in from different directions takes place at this point, and it is doubtless in part this huge movement serving to gather together and concentrate the solid material from the converging currents that explains the unusual richness, both in species and numbers of individuals. It was also at this point that many species hitherto reported from the East India islands were found.

The Philippine Islands are very advantageously located with reference to the great ocean currents, the chief carriers of diatoms from one part of the world to another. The great northern and the southern equatorial currents converge on the eastern and southern shores of the Philippines and spread their waters about the island group. Other currents skirt the islands of the East Indies, New Guinea, Celebes, and Borneo on their southern sides, Java on its northern side, Sumatra and parts of the Malay Peninsula on their eastern sides; they then stream northward and northeastward to come to rest along the western coasts of the Philippines. The Sulu Sea is especially a focal center for many such currents, and represents one of the most complexly connected oceanographic localities known. On the other hand, the cold current from Bering Sea and the Arctic which flows southwest along the coasts of Kamchatka, Manchuria, and the eastern side of Korea is here pushed back by a warm current moving up between Korea and Japan and fails to reach the Philippines. It is quite evident that this great convergence of powerful ocean currents is largely responsible for the rich flora and fauna of the Philippine waters.

Another thing helping to bring about this richness of marine life at the Philippines is the great range of depth of its waters. The eastern shores lie adjacent to some of the most profound depths in the Pacific Ocean, one point just east of the northern end of Mindanao being the deepest sea abyss yet discovered, 5,350 fathoms, or 32,100 feet, or over 6 miles. On the other hand, the western side is shallow and many of the channels between the islands are extremely so. Thus Manila Bay has an average depth of only 3 to 4 fathoms. This wide diversity of depth, with its attendant range in temperature, salinity, and light, must be responsible to no small degree for the diversity of life, including diatom life at the Philippines.

There is in preparation a report on the diatoms of the Hawaiian Islands, studies for which, though incomplete, reveal the fact that outside of strictly cosmopolitan species, hardly any of the Hawaiian diatoms are represented in the Philippine flora. This probably is accounted for not so much by the distance between them as by the fact that the powerful northern equatorial current flowing westward across the Pacific passes a little too far south of the Hawaiian Islands to carry away any appreciable amount of its marine flora.

There is no necessity to record in detail the technique used in preparing material for this investigation, beyond the statement that a sufficient number of strewings of each cleaned sample was made by spreading on a microscope slide and drying over a spirit lamp. These were then carefully searched for new forms, which when found were picked up and mounted separately in styrax, Canada balsam, or some other medium. By this method each species is preserved as a single herbarium speicmen and, when properly labeled, represents the species recorded here, with none of the uncertainty that always goes with identification based on strewn slides. The labor involved of course is considerable, but the great convenience and accuracy secured fully justify it. No attempt was made to preserve duplicate specimens of species if they were subsequently found in material from other localities. The labor of making these and of preparing a list of species for each one of the many dredgings examined would have been great; and in this case it would have been nearly superfluous, seeing that, as above mentioned, the precise location of each dredging was unknown.

All the new species herein described are represented by their type specimens deposited in the United States National Museum, and the serial number of each one is given at the end of the description. With the exception of four or five specimens all the other species here enumerated and any specially noted varieties are also deposited in the Museum, the few lacking having been on slides made by other diatomists and duplicates of them not having been subsequently found by the author. None of these missing species, however, are rare, and authentic examples of them can be seen in the general diatom collection of the Museum.

A few strictly plankton diatoms are incidently included in this report, but they doubtless represent merely accidental additions to the true flora, the bottom-living diatoms. No plankton samples were available, nor could they have been taken as characteristic of any particular locality. Doubtless the Philippine Islands as a whole have a plankton life differing in a general way from that of far distant places. But as all marine plankton forms are wanderers, swept from one locality to another by sea currents and the surface drift of the waters they inhabit, it is quite idle to report them as belonging to any one locality. American students of plankton diatoms are well aware of how closely the European species correspond to those drifting along our own Atlantic seaboard or even those of the Pacific coast, a parallel conspicuously absent from the diatom floras of the bottom-living species of Europe and America.

It is therefore practically immaterial that a list of the plankton diatoms is not included in this report, as its purpose is to record the truly characteristic diatom flora of the Philippines; that is to say, those species that have their fixed and natural habitat in those waters.

SIMILARITY OF CAMPECHE BAY AND PHILIPPINE ISLANDS DIATOM FLORAS

A remarkable fact has been brought out by this study of Philippine Island diatoms, their close similarity to those of Campeche Bay in the Gulf of Mexico. How great this really is can only be conjectured at present, for a thorough study of the Campeche Bay diatoms has never been undertaken. A more extended examination of material from there is much to be desired, so as to see how far this interesting correspondence goes. But even such meager references to Campeche Bay forms as have been met with in Schmidt's Atlas and other publications during these studies have established the fact that many species, and especially many unique varieties, are common to these two localities and rarely if ever found elsewhere. The value of extending this comparison in this particular instance is because there evidently is involved here a certain law or laws of development which, if discovered, will help to explain some curious marine biological puzzles. For we have in these places a case of extreme isolation from each other, and yet a notable similarity in their diatom flora. Not only are they geographically remote, but the vast barrier of North and South America is interposed between them; so that any connection by means of ocean currents is absolutely out of the question. It should be mentioned that the materials were collected before the opening of the Panama Canal, through which, as time goes on, there will take place a slow but steady transference of small forms of animal and plant marine life.

At first it might seem equally strange were certain rare species of diatoms discovered to be common to the shores of Alaska and of the Hawaiian Islands; but such a coincidence would be no parallel to this one. For it could well be explained by assuming that the golden plover, as well as certain ducks, curlews, and other shore birds, known to migrate annually between these two remote places were the carriers responsible for such striking cases of similarity. Or, to take another example, it is now well established that there are currents which bear logs and other drift from northwestern America to the far off shores of the Hawaiian group; and it is believed that some of the old war canoes found on these islands were made from trees not native there, but indigenous to such remote localities as Oregon and the shores of Puget Sound. Here again a satisfying explanation for any diatom identities that may exist in the two places is supplied; for such ships of passage might, and in fact did, bear as freight hosts of marine animal and plant life from one shore to the other. But so far as is known to science there is no communication, bird or otherwise, between Campeche Bay and the Philippines, or even between Campeche Bay and the Pacific coast; and it is certain no drifting log could make such a journey without rounding the Arctic end of North America or the Antarctic end of South America, and thereby subjecting these subtropical diatoms to the fatal rigors of low temperature. In the matter of diatom transportation, it should also be borne in mind that the difficulties that confront these organisms do not apply to some other marine groups. Thus they must be literally transported from one spot to another, as their limited locomotion consists merely of crawling infinitesimal distances, but not of free swimming; and also the brief life duration of the individual, only a few days at most, prevents its bridging over long-continued adverse conditions during an extensive journey of many thousands of miles. It is pretty sure the Campeche Bay diatoms have not made the trip to the western coast of America by any means whatever, seeing that its characteristic species have never been reported from those regions.

If we try to see in this Campeche Bay-Philippine diatom parallel a case of "discontinuous distribution" the lateness of the appearance of diatoms geologically, hardly as early as the bottom of the Pliocene, would still leave us confronted by the barrier of the American continent, preventing any transportation to the Pacific Ocean; while if we imagine an eastern transportation, the western shores of Africa, the Indian Ocean or the shores of Java, Sumatra, or Celebes would be much more likely to afford us Campeche Bay forms than the Philippine Islands, lying so far east of them. There are indeed many species common to the Philippines and these islands of the East Indies, but they are not Campeche Bay diatoms.

The list of coincidences here given is very incomplete, because it leaves out many species common to both but having little significance, as they are practically cosmopolitan diatoms. And yet if each flora were grouped into a picture and the two compared, these additional forms, not peculiar to the two places but present in both, would greatly increase their resemblance. I think it will be admitted there is a greater significance in the duplication of unique varieties in the two floras than in the duplication of species, because it indicates a peculiarly close and exact correspondence carried out to its minutest degree. In other words, such cases are not merely similar but literally identical. Thus the slight incurving on the dorsal side of *Amphora spectabilsi* Gregory which marks the variety figured in Schmidt's Atlas, plate 40, figure 21, from Campeche Bay, is sharply duplicated in my specimen from the Philippines; the Philippine specimens of *Navicula pelagi* A. Schmidt could be used to reproduce its figure in Schmidt's Atlas, plate 7, figure 26, from Campeche Bay, so accurately does it agree in line and curve and every minute detail. In Schmidt's Atlas, plate 2, figure 20, is an illustration of what I consider to be a very doubtful example of *Navicula approximata* Greville, and which Grunow calls var. *substauroniformis.* This Campeche Bay specimen is so exactly like one I have from the Philippines that the word "identical" is fully justified.

When, therefore, diatom floras from two widely separated places parallel each other in so many minute particulars, the fact suggests that the factors determining these forms must also be strikingly alike; and problems of environmental and perhaps genetic influence are conjured up that well deserve further attention.

LIST OF CAMPECHE BAY-PHILIPPINE DIATOMS

A. Found nowhere else

Amphora crassa, var. *campechiana* Grunow in Schmidt, Atlas, pl. 28, fig. 16.
Auliscus caelatus, var. *latecostata* A. Schmidt in Schmidt, Atlas, pl. 32, figs. 16–20.
Biddulphia juncatensis (Grunow) Mann in Schmidt, Atlas, pl. 76, fig. 13.
Campylodiscus muelleri A. Schmidt in Schmidt, Atlas, pl. 14, fig. 13.
Campylodiscus phalangium A. Schmidt in Schmidt, Atlas, pl. 14, figs. 11–12.
Campylodiscus punctulatus Grunow in Schmidt, Atlas, pl. 17, fig. 4.
Campylodiscus triumphans A. Schmidt, in Schmidt, Atlas, pl. 15, figs. 4–5.
Coscinodiscus exiguus Rattray in Schmidt, Atlas, pl. 58, fig. 30.
Mastogloia grundleri A. Schmidt in Schmidt, Atlas, pl. 188, fig. 26.
Navicula approximata, var. *substauroneiformis* Grunow in Schmidt, Atlas, pl. 2, fig. 20–21.
Navicula californica, var. *campechiana* Grunow in Schmidt, Atlas, pl. 3, fig. 19.
Navicula carinifera Grunow in Schmidt, Atlas, pl. 2, fig. 1.
Navicula coarctata Ehrenberg, var.? in Schmidt, Atlas, pl. 11, figs. 20–21.
Navicula formicina Grunow in Schmidt, Atlas, pl. 160, figs. 38–41.
Navicula intercedens A. Schmidt in Schmidt, Atlas, pl. 160, figs. 3–5.
Navicula lacrimans A. Schmidt in Schmidt, Atlas, pl. 12, figs. 59–60.
Navicula margarita A. Schmidt in Schmidt, Atlas, pl. 174, fig. 17.
Navicula multicostata Grunow, var. in Schmidt, Atlas, pl. 11, fig. 20.
Navicula pelagi A. Schmidt in Schmidt, Atlas, pl. 7, figs. 25–26.
Navicula probabilis A. Schmidt in Schmidt, Atlas, pl. 50, fig. 46.
Navicula pudens, new species, in Schmidt, Atlas, pl. 7, fig. 49 (no name).
Navicula serrulata Grunow in Schmidt, Atlas, pl. 7, figs. 42–43.
Navicula splendida Gregory, var. in Schmidt, Atlas, pl. 69, fig. 22.
Navicula splendida Gregory, var. in Schmidt, Atlas, pl. 69, fig. 15 (misnamed).
Nitzschia fluminensis, var. *majuscula* Grunow in Van Heurck, Synopsis, pl. 62, fig. 5.
Nitzschia weissfloggi Grunow, var. in Peragallo, Diatom. France, pl. 76, fig. 34.
Surirella fastuosa Ehrenberg, var. in Schmidt, Atlas, pl. 5, fig. 11.
Surirella fluminensis Grunow, var. in Schmidt, Atlas, pl. 4, fig. 9.

B. Found also, more or less rarely, in other localities.

Amphora alata Peragallo.
Amphora crassa Gregory, typical form.
Amphora egregia Ehrenberg.
Amphora exsecta Grunow.
Amphora formosa Cleve.
Amphora furcata Leuduger-Fortmorel.
Amphora fusca A. Schmidt.
Amphora gibba A. Schmidt.
Amphora gigantea Grunow.
Amphora grundleri Grunow.
Amphora inflata Grunow.
Amphora schmidtii Grunow.
Biddulphia antillarum (Cleve) Boyer.
Biddulphia campechiana (Grunow) Mann.
Biddulphia elegans Greville.
Biddulphia pentecrinus (Ehrenberg) Boyer.
Biddulphia scitula (A. Schmidt) Mann.
Campylodiscus adornatus A. Schmidt.
Campylodiscus concinnus, var. *lineata* Grunow.
Campylodiscus rabenhorstianus Janisch.
Campylodiscus rattrayanus Deby.
Cistula lorenziana Cleve.
Climacosphenia moniligera Ehrenberg.
Coscinodiscus nitidulus Grunow.
Coscinodiscus variolatus Castracane.
Cymatoneis sulcata (Greville) Cleve.
Mastogloia rhombus (Petit) Cleve.
Navicula approximata Grunow.
Navicula campylodiscus Grunow.
Navicula chersonensis Grunow.
Navicula diffusa A. Schmidt.
Navicula excavata Greville.
Navicula forcipata, var. *densistriata* A. Schmidt.
Navicula graeffii Grunow.
Navicula hennedyi W. Smith.
Navicula inexacta, new name.
Navicula longa Gregory.
Navicula (marginata) janischii Castracane.
Navicula marginata Lewis.
Navicula puella A. Schmidt, typical form.
Navicula separabilis A. Schmidt.
Navicula weissflogii A. Schmidt.
Nitzschia campechiana Grunow.
Nitzschia distans, var. *tumescens* Grunow.
Nitzschia fluminensis Grunow, typical form.
Nitzschia marginulata, var. *subconstricta* Grunow.
Nitzschia pulcherrima Kitton.
Nitzschia valida Cleve and Grunow.
Nitzschia valida (var. in Van Heurck, Synopsis, pl. 65, fi[illegible]
Trigonium cinnamomeum (Greville) Mann.

NOMENCLATURE

The nomenclature used in this report is that which has received the general approval of leading diatomists throughout the world. It involves the rejection of a few names, chiefly generic names, which appear earlier in print, but with verbal description or illustration—or in some cases both—so meager and unsatisfactory as to make it a safer plan to treat them as *nomina nuda* than to accept the alternative, to so amend and amplify them that they will be distinctively marked off from other genera subsequently discovered. They comprise chiefly the following: *Hemiptychus* for the universally used *Arachnoidiscus*, *Tripodiscus* for *Aulacodiscus*, *Sphinctocystis* for *Cymatopleura*, *Cystopleura* for *Epithemia*, *Gyrosigma* for *Pleurosigma*, and *Tessella* for *Rhabdonema*. These practically defunct genera were admitted into my Diatoms of the Albatross Voyages, but with misgivings as to the necessity and wisdom of the change, a statement to that effect being made in the introduction. I am glad to here note that this upsetting of classical and long established names on my part has not had the slightest influence on subsequent diatom literature.

While holding to the rigid enforcement of the law of priority in nomenclature in present and future cases, I wish to call attention to the exceptionally disastrous result of its retroactive enforcement in diatom nomenclature. Many of the names above recorded have been in extensive use for a half century or more in scientific literature, outside of technical diatom publications, as well as in popular literature, because of the uses of diatoms as test objects to determine the excellence of optical instruments, together with other uses. Thus *Pleurosigma angulatum* is known to every microscopist or user of optical instruments, and has long been an integral part of literature bearing on applied optics. But nobody has heard of *Gyrosigma thuringicum*, a name applied to the same diatom at a slightly earlier date. And what intensifies the difficulty of justifying such drastic retroactive enforcement of a new rule here is that the great works of diatom taxonomy are rare and so expensive to produce that there is little, if any, chance of new editions ever being published. The identification of ninety-nine hundredths of the 7,000 or more species of diatoms must always be done by means of these classical illustrated publications, as, for example, the works of William Smith, Ehrenberg, Greville, Gregory, Grunow, Schmidt, De Toni, Van Heurck, in all of which these long accepted names are generally used, in preference to the obscure and more or less questionable ones above mentioned.

After many years of diatom study I have come to repose great confidence in the opinions of the late Dr. Henri Van Heurck, because of his wide knowledge and his spirit of conservatism; and in this matter of the above obscure names his position is the same as that already stated.

On another point of nomenclature this report is in accord with Van Heurck, as to P. T. Cleve's plan for dividing the unwieldy genus *Navicula* into a number of genera. He accepts these as useful subgeneric divisions of that huge genus, but considers them to be too difficult of sharp definition to justify their adoption as valid genera. But he does recognize, and I think correctly, three exceptions to the foregoing, *Cistula*, *Cymatoneis*, and *Frustulia*. For the last he favors Brébisson's synonym, *Van Heurckia*, but with this I can not agree. As will be explained under these names, these three seem to be sufficiently unlike other Naviculae to justify their separation.

The general custom among diatomists of capitalizing proper names is not followed in this report, as it conflicts with the rules governing the scientific publications issued by the United States National Museum. The author therefore contents himself with here stating that to him the necessity for such capitalization seems to be at times undeniable; as, for example, *Navicula Liber* W. Smith.

All of the material examined for this report was collected by the steamer *Albatross* of the United States Bureau of Fisheries; and the writer wishes to express here his appreciation of the great service the Bureau of Fisheries has rendered to science, and especially to oceanography, by these and the vast number of other collections it has secured and freely made available to investigators.

As the genera and their species are both arranged in the text in strict alphabetical order, a final alphabetical index is omitted as unnecessary.

GENERA AND SPECIES, WITH SYSTEMATIC DISCUSSIONS

Genus ACHNANTHES Bory

ACHNANTHES COCCONEIFORMIS, new species

Plate 1, fig. 1

Valves broadly elliptical with a barely perceptible angular or prismatic outline; apices pointed; under valve marked with strong, smooth costae slightly radial and straight at the center of the valve, increasingly radial and curved toward the apices; each costa enlarged at the outer marginal end; a narrow stauros reaching to the margin; central area narrow, elliptical, about one-fifth the width of the valve, reaching the apices. The valve figured in Schmidt's Atlas, plate 198, figure 41, unnamed, seems to be the same diatom.

Length 0.079; width 0.033; costae 6 in 0.01 mm.

Type.—Cat. No. 43560, U.S.N.M.

ACHNANTHES COMPACTA, new species

Plate 1, fig. 2

Valves elongated, with evenly rounded ends and parallel sides barely constricted at the center; under valve crossed by double rows of beading separated by costae, as in *A. longipes* Agardh, nearly transverse at the center, increasingly radial toward the ends; a narrow linear transverse stauros, no hyaline median area bordering the rhaphe; upper valve with same beading as under valve.

Length 0.039; width 0.012; 6 double lines in 0.01 mm.

Type.—Cat. No. 43561, U.S.N.M.

The shape of this new species is closely similar to that of *A. subsessilis* Kützing, which, however, like *A. brevipes* Kützing, has single rows of beads without separating costae. The beading is like *A. longipes*, from which it differs both in outline and in being, despite its small size, a relatively much more massive diatom, with thick, heavy frustules. It is also more coarsely beaded; thus for *A. longipes* with a length of 0.2 mm. we have six double rows in 0.01 mm. (see De Toni, Syl. Alg., p. 470) while here six rows are found on a valve of only 0.039 mm. *A. longipes* occurs in the Philippines and the two are unmistakably distinct. The species is abundant at Jolo Jolo, Sulu Islands. It was not found elsewhere in the Philippine Islands. It, however, occurs at the Laysan Islands, and has an average length of about 0.04 mm.

ACHNANTHES CRENULATA Grunow

(Cleve and Grunow, Arct. Diat., p. 20; figure in Le Diatomiste, pl. 9, figs. 3–4.)

The measurements of my specimen are: Length 0.079; width 0.018; 7 lines in 0.01 mm.

ACHNANTHES HETEROMORPHA Grunow

(According to Cleve in Schmidt, Atlas, pl. 198, figs. 52–58.)

This might be better classified as *Cocconeis*. Its resemblance to *A. lanceolata* (Brébisson) Grunow may be responsible for placing it under *Achnanthes*. It has no trace of bend in the girdle view in any of the specimens I have examined. It has some likeness to *A. flahaulti* Heribaud (Diat. foss d'Auverg., 1903, pl. 10, figs. 17–18) except for the stauros.

ACHNANTHES HEXAGONA Brun and Cleve

(Brun, Espec. Nouv., p. 5, pl. 19, figs. 3*a*–*b*.)

ACHNANTHES INFLATA (Kützing) Grunow

(Grunow, Reise, F. Novara, p. 98.)

It is Ehrenberg's *A. ventricosa* (1854) (not Kützing, 1844), and is well figured in Ehrenberg's Mikrogeologie (pl. 3, figs. 18–19).

ACHNANTHES LONGIPES Agardh

(Smith, Brit. Diat., pl. 36, fig. 300.)

ACHNANTHES TENUISTAUROS, new species

Plate 1, figs. 3–6

Valves very broadly fusiform, sometimes very broadly oval; ends acuminate, rounded; under valve with markings of double rows of beading with separating costal lines, strongly radiating; median area almost absent and with rhaphe strongly or obscurely tortuous; transverse stauros sharply distinct but very narrow, not at all flaring toward the ends, which are usually distant from the margins one-quarter the width of the valve. Upper valve as the under one, its median line very narrow.

Length 0.053–0.091; width 0.031–0.047; 9 lines in 0.01 mm.

Species somewhat resembling this are—

A. baldjikii (Schmidt's Atlas, pl. 198, figs. 44–48).
A. danica Cleve (Schmidt's Atlas, pl. 198, figs. 60–61).
Navicula vaszaryi Pantocsek (Hung. Diatom., pt. 3, pl. 16, fig. 239).
A. exigua Grunow (Van Heurck, Synopsis, pl. 27, figs. 29–30).
Achnanthidium danicum Flogel (Schmidt, Atlas, pl. 198, fig. 50).
A. javanica Grunow (Diat. Siam, Oestrup, pl. 1, figs. 15–16).

Its nearest published resemblance is found in the unnamed figure in Schmidt's Atlas, plate 198, figure 49.

Type.—Cat. No. 43562, U.S.N.M.

Genus ACTINOCYCLUS Ehrenberg

ACTINOCYCLUS BIPARTITUS, new species

Plate 1, fig. 7

Valve almost flat except near the margin where the convexity is sudden, its surface sharply separated into two areas, an inner sparsely beaded and an outer densely beaded area; the former with about 25 radii of widely spaced beads, with somewhat shorter rows interspaced between them; this inner area, with a diameter of a little over one-half that of the valve, is surrounded by the densely beaded outer area, composed of the extension of the radiating rows of the former plus other interpolated rows; all the rows slightly tortuous; near the margin of the valve the beading becomes compacted into even, closely set rows, the beads progressively smaller; about 25 obscure processes near the margin at the ends of the 25 or more primary radii; psuedonodule minute, evident, close to the margin, surrounded by a small circular hyaline area.

Diameter 0.079 mm.

This species somewhat resembles *A. sparsus* (Gregory) Rattray (Micro. Journ., 1857, pl. 1, fig. 47) and Rattray (Rev. Actinocyclus, p. 170); also *A. punctulatus* Castracane (Chall. Exp., pl. 16, fig. 3) and its variety *A. nebulosus* Peragallo (Diat., France, pl. 113, fig. 11.)

Type.—Cat. No. 43563, U.S.N.M.

ACTINOCYCLUS CURVATULUS Janisch

(Janisch, Gaz. Exp., pl. 5, fig. 8; Schmidt, Atlas, pl. 57, fig. 31.)

ACTINOCYCLUS DECUSSATUS, new species

Plate 2, figs. 1–2

Surface of valve evenly and densely covered with beading radially arranged, but so spaced as to produce the watchcase pattern seen in *Hyalodiscus subtilis* Bailey, etc., and to display forty to fifty of the radii characteristic of *Actinocyclus*, but very obscurely, or in some specimens apparently lacking; no central hyaline area; beading adjacent to the margin a trifle more compact and slightly smaller than within; center of the valve raised into a low conical elevation one-third to one-quarter the diameter, surrounded by a shallow depressed ring one-sixth to one-eighth the diameter, with the outer area raised to the same focal plane as that of the central cone; pseudonodule large, robust, surrounded by a narrow hyaline space and placed on the extreme outer margin.

Diameter 0.08 to 0.18 mm.

Type.—Cat. No. 43564, U.S.N.M.

ACTINOCYCLUS OBSCURUS Rattray

(Rattray, Rev. Actinocyclus, p. 187, pl. 11, fig. 5.)

ACTINOCYCLUS PRUINOSUS Castracane

(Castracane, Chall. Exp., pl. 4, fig. 2, as defined in Rattray, Rev. Actin., p. 167.)

ACTINOCYCLUS PUNCTULATUS Castracane

(Castracane, Chall. Exp., p. 146, pl. 16, fig. 3.)

This is the same as Peragallo's *A. nebulosus* (Diat., France, pl. 113, figs. 10–11.)

ACTINOCYCLUS ROTULA Brun

(Brun, Espec. Nouv., p. 6, pl 17, fig. 5.)

Specimens typical according to Brun's figure are frequent; but this species may be only a variety of *A. sparsus* (Gregory) Rattray.

ACTINOCYCLUS SPLENDENS Rattray

(Rattray, Rev. Actinocyclus, p. 168, pl. 11, fig. 14.)

ACTINOCYCLUS STICTODISCUS

See under *Stictocyclus*, new genus.

ACTINOCYCLUS SUBTILIS (Gregory) Ralfs

(Pritchard, Infusoria, p. 835; Van Heurck, Synopsis, pl. 124, fig. 7; H. L. Smith, Types, No. 14.)

Genus ACTINODISCUS Greville

ACTINODISCUS SCHLEINITZII (Janisch) Mann

(Schmidt, Atlas, pl. 149, fig. 19; Janisch, Gaz. Exp., pl. 20, figs. 18–19.)

Specimens of this diatom were found in several of the Philippine Islands dredgings, but in no case was there present an *Actinoptychus* or other circular diatom to which it could be referred as "an inner valve," to confirm the suggestion of Van Heurck (Treat., p. 501). But the creation of a new genus for this form, as is done by Schmidt (Atlas, pl. 149, fig. 19), where it is named *Gyroptychus contabulatus* A. Schmidt, is quite unnecessary. It should be classed under *Actinodiscus* as defined in Van Heurck's Treatise, p. 497. Compare it with *A. barbadensis* Greville in Schmidt, Atlas, plate 132, figure 1, and *A. grayii* Grove in Schmidt, Atlas, plate 184, figure 1. Some of my specimens have 9, others 14 divisions. Janisch (Gaz. Exp., pl. 20, figs. 18–19) accurately figures it but calls it *Polymyxus schleinitzii. Polymyxus* Bailey, based upon *P. coronalis*, can not be successfully separated from *Aulacodiscus;* but Janisch's specific name, *schleinitzii*, given in 1888 (1889?) antedates that of Schmidt, 1890. However, this can not go over with *Polymyxus* into *Aulacodiscus*, seeing that it has a decided ridge traversing each elevated sector of the circle and ending at the margin in a sessile ocellus, not in a pedicelled horn.

Genus ACTINOPTYCHUS Ehrenberg

ACTINOPTYCHUS ANNULATUS (Wallich) Grunow

(Van Heurck, Treat., p. 495, fig. 237; Micros. Journ., 1856, pl. 12, fig. 15.)

There is reason for looking on this generic classification with dissatisfaction, and several other assignments of this diatom have been made. Wallich's original name was *Triceratium annulatum*. Grunow (Bot. Centralblatt, vol. 15, No. 10, p. 36.), suggested the new generic name, *Cymatogonia*. De Toni (Syl. Alg., p. 1395) proposed the untenable new genus *Schuettia* and unites this form with the similar *Actinoptychus amblyceros* (Ehrenberg) A. Schmidt, the less similar *Triceratium marylandicum* Brightwell and *T. neogradense* Pantocsek, and the wholly unlike *T. trigonium* A. Schmidt and *Actinoptychus trilingulatus* (Brightwell) Ralfs. On the whole the position taken by Van Heurck, who retains this form in *Actinoptychus*, is the least unsatisfactory one. (See Van Heurck, Treatise, p. 496.)

ACTINOPTYCHUS AREOLATUS (Ehrenberg) A. Schmidt

(Schmidt, Atlas, pl. 1, fig. 9.)

It is doubtful if this can be held as a valid species rather than a wide variety of the variable *A. undulatus* (Bailey?) Ralfs. But it is the prevailing form in the Philippine Islands, where it contrasts rather sharply with the typical *A. undulatus*.

ACTINOPTYCHUS HEXAGONUS Grunow

(Schmidt, Atlas, pl. 1, figs. 15–17.)

Large and elegant specimens of the truly hexagonal form are not uncommon in the Philippine Islands, as well as a great variety of gradations into strictly circular specimens.

ACTINOPTYCHUS HISPIDUS Grunow

(Van Heurck, Synopsis, pl. 123, fig. 2.)

ACTINOPTYCHUS JANISCHII Grunow

(Schmidt, Atlas, pl. 153, figs. 8–10.)

ACTINOPTYCHUS PARVUS, new name

Plate 1, fig. 8

Sector of valves about 12, all evenly pebbled with closely set beading, no superimposed network or anastomosing lines, no hyaline area across outer ends of sectors or between them, and no hyaline line bisecting each sector; a hyaline central rosette about one-eighth the diameter of the valve; a small but evident process at the margin in the middle of each sector; difference in focal plane of alternating sectors slight—that is to say, undulation of valve surface small.

Diameter 0.045–0.059 mm.

Type.—Cat. No. 43565, U.S.N.M.

This minute and delicate species, abundant in the Philippine Islands and rather widely distributed elsewhere, seems to have been generally overlooked, probably having been taken for a small variety of *A. splendens*. It is figured in Schmidt, Atlas, plate 132, figure 15, from a specimen from Yokohama, but is misnamed *A. laevigatus* Grunow, a fossil species from Monterey, Calif., which it only slightly resembles. This can be seen by comparing it with Grunow's original figure (Van Heurck, Synopsis, pl. 122, fig. 7). It also is like the intermediate *A. biseptinarius* Ehrenberg in Mikrogeologie, plate 33, section 16, figure 5, one of a long list of names given by Ehrenberg to similar or identical species, basing the distinctions on the unimportant quality of the number of sectors into which the specimens happened to be divided. This entire series of over 100 names is therefore rejected by diatomists.

I incorrectly called a specimen of the present species *A. moelleri* Grunow in my Diatoms of the Albatross Voyages (p. 271). It resembles this, but only in a general way.

ACTINOPTYCHUS SPLENDENS (Ehrenberg) Shadbolt

(Van Heurck, Synopsis, pl. 119, figs. 1–4; pl. 120, figs. 1–4; Schmidt, Atlas, pl. 153, fig. 16.)

ACTINOPTYCHUS SUBANGULATUS A. Schmidt

(Schmidt, Atlas, pl. 132, fig. 11.)

Schmidt's figure represents a form with 16 sectors; my specimen has 20 sectors.

ACTINOPTYCHUS TRILINGULATUS (Brightwell) Ralfs

(Schmidt, Atlas, pl. 1, fig. 20.)

See reference under *A. annulatus* (Wallich) Grunow.

ACTINOPTYCHUS UNDULATUS (Bailey) Ralfs

(Pritchard, Infusoria, pl. 5, fig. 88; Schmidt, Atlas, pl. 1, figs. 1–6.)

Both the typical form and many varieties of this cosmopolitan diatom were found, including the untenable *A. tenarius* Janisch (Schmidt, Atlas, pl. 1, fig. 2), which in Fricke's Verzeichniss of

Schmidt's Atlas is correctly included here, it being nothing more than an immature valve.

ALLONITZSCHIA, new genus

Valve elongated, bilaterally unsymmetrical, tapering to the slightly curved apices, *Nitzschia*-like; its dorsal side straight, ornamented with a closely set row or chain of polygonal divisions forming a heavy border, slightly over one-half the width of the valve and proportionally decreasing in size toward the gracefully tapered apices; ventral side slightly convex, its margin gently undulate, the undulations corresponding to barely perceptible elevations and depressions or waves of the valve surface running across the valve and corresponding in number to the polygonal divisions of the dorsal border; the whole valve, including this border, covered with fine transverse rows of beading.

Side (girdle) view narrow rectangular, the lines or costae of the polygonal dorsal border of the valve here appearing as septal thickenings, thereby having the appearance of crossbars, like those seen in girdle views of *Denticula lauta*, *Epithemia zebra*, etc.

ALLONITZSCHIA MUNIFICA, new species

Plate 2, fig. 3

Characters those of the genus. I found but one species and after much searching could obtain only a single specimen; but fortunately this was a complete frustule. Its general appearance is near to that of *Nitzschia*, or to that section of it now generally classed as *Hantzschia*, as the striking row of polygonal divisions forming a border along one edge is on the same side, not the opposite side, of each valve of the frustule.

Length of valve 0.118; widths 0.010; dorsal division 1.4 in 0.01; beaded lines 9 in 0.01 mm.

Found at Jolo Jolo, Sulu Islands.

Type.—Cat. No. 43566, U.S.N.M.

Genus AMPHIPRORA Ehrenberg

Exclusive of those forms which seem to me rightly to be included by Cleve in his new genus, *Tropidoneis*, which see.

AMPHIPRORA LIMPIDA, new species

Plate 3, fig. 1

Valve of characteristic shape, nearly bisected by the middle sinus, the two arched halves having a broad heavy rim along the dorsal side beaded on its lower edge; the inner ventral edge of the valve nearly straight but curving slightly at the ends, and bordered by a heavy band, crossbarred, with the but slightly curved rhaphe as its upper outline; the two lunate spaces between the rim of the bicurved dorsal side and the broad straight band of the ventral side show faint traces of lines connecting the single row of beads of the former with the crossbars of the latter; the terminal beads of the rhaphe large and at the extreme tips of the valves; central nodule broad but obscure.

Length 0.117, width 0.019 mm.

This delicate species resembles in form, but not in markings, *A. paludosa* W. Smith, typical specimens of which also occur in the Philippine Islands.

Type.—Cat. No. 43567, U.S.N.M.

AMPHIPRORA O'SWALDII Janisch

Plate 3, fig. 2

(Janisch, Gaz. Exp., pl. 20, figs. 22–24.)

Although there is considerable resemblance between this and the doubtful example of *Nitzschia* which Cleve calls *N. ocellata* (New and Little-Known Diatoms, pl. 4, fig. 47), I take this at least to be a true *Amphiprora*, one of my specimens showing the complex and interlaced girdle of this genus.

AMPHIPRORA PALUDOSA W. Smith, var.?

(Smith, Brit. Diat., pl. 31, fig. 269; Van Heurck, Synopsis, pl. 22, fig. 10.)

This diatom in the Philippines varies considerably from its type. In fact, were we to judge from Smith's description on page 44 of the above reference, and especially by the figure there given, which is by the generally accurate artist, Tuffen West, we should be justified in calling the Philippine form a new species. But when we compare with more recent illustrations, such as the one given above by Van Heurck, it is safer to consider the specimen as a variety of Smith's diatom. My specimen measures length 0.169 mm., with 4.5 lines in 0.01 mm., measured midway on the dorsal curves.

AMPHIPRORA PELAGICA Brun

(Brun, Espec. Nouv., pl. 23, figs. 3–4.)

AMPHIPRORA PLICATA Gregory

(Gregory, Diat., Clyde, pl. 12, fig. 57.)

AMPHIPRORA TEMPEREI Cleve

(Le Diat., vol. 1, pl. 2, fig. 3.)

Genus AMPHORA Ehrenberg

AMPHORA ALATA Peragallo

(Peragallo, Diat., France, pl. 43, figs. 4–5; Schmdit, Atlas, pl. 26, figs. 60–61, no name.)

AMPHORA ALTERNATA, new species

Plate 3, fig. 3

Dorsal side of valve convex in an even arc; ventral slightly biconvex, constricted in the center; ends broad and rounded, not flexed; rhaphe double bow-shaped with a strong central nodule, the ends slightly reflexed; no hyaline area; beading in closely set transverse rows of oval or rectangular beads, the spacing of each row alternating with that of the rows on either side, thus producing a basketwork or brick pattern. A robust, massive diatom.

Length 0.141; width 0.034; 6 lines in 0.01 mm.

Type.—Cat. No. 43568, U.S.N.M.

AMPHORA ANCEPS, new species

Plate 3, fig. 4

Valve broad, the breadth one-half the length; the dorsal side with a deep central indentation, resulting in two pronounced peaks; the apices of the valve produced into two short extensions, contiguous with the ventral side and slightly reflexed at the tips; ventral side nearly straight, barely indented at the center; rhaphe close to and parallel with the ventral side; markings rows of elongated beads, the interspaces the same width as the rows, transverse at the center of the valve and increasingly curved outward toward the apices.

Length 0.068–0.090; width 0.024–0.040; 7 lines in 0.01 mm., measured along the ventral side.

There is a general resemblance between this diatom and *A. corpulenta* Cleve and Grove, both in its breadth and in the arrangement of its beading.

Type.—Cat. No. 43569, U.S.N.M.

AMPHORA ANGUSTA Gregory

(Schmidt, Atlas, pl. 25, figs. 8, 14, according to Cleve, Nav. Diat., vol. 2, pp. 135–6.)

I have two specimens which correspond with the above two figures in Schmidt's Atlas. But Cleve has made a painstaking study of *A. angusta* Gregory and *A. cymbelloides* Grunow and writes that Schmidt's two figures represent, not, as there stated, *A. cymbelloides*, but *A. angusta*, which latter, he says, is much more delicately marked. He gives for *A. angusta*, 7 to 17 lines in 0.01 mm. and for *A. cymbelloides* at least 29 lines in 0.01 mm. My specimens have 8.3 and 12.5 lines in 0.01 mm.

AMPHORA ARCUATA A. Schmidt

(Schmidt, Atlas, pl. 25, figs. 27–29.)

This is not to be confused with the form bearing the same name in Pantocsek (Hung. Diat., vol. 2, 1888, pl. 4, fig. 70). Schmidt's identification has priority, 1875.

AMPHORA ARENARIA Donkin

(Peragallo, Diat., France, pl. 48, figs. 11–14.)

AMPHORA BICONVEXA Janisch

(Schmidt, Atlas, pl. 25, fig. 68.)

Although Cleve in his Naviculoid Diatoms (vol. 2, p. 137) and some other diatomists admit this to specific rank, it is too close to *Amphora bigibba* Grunow.

AMPHORA CAMELUS Cleve and Grove

(Le Diat., vol. 1, p. 158, pl. 22, figs. 9–12.)

Curiously, I have selected the name *A. dromas* for this diatom before finding the above illustration—a more descriptive name, as this species has two humps. Measurements of my specimen were, length 0.095; width 0.028; lines 6 in 0.01 mm.

AMPHORA CLARA A. Schmidt

(Schmidt, Atlas, pl. 25, fig. 20.)

The type was found in material from the nearby waters of Yokohama.

AMPHORA CLATHRATA, new species

Plate 3, fig. 5

Dorsal side of valve slightly convex for most of its length, then rapidly curving toward the blunt rounded ends; ventral side nearly straight, but indented at the center; rhaphe adjacent to and parallel with the ventral side; central nodule obscure; no hyaline area; terminal nodules on lower side of the rounded ends elongated and reflexed; markings heavy, closely set, transverse costae extending from the ventral edge to within one-quarter that of the dorsal side, this one-quarter marked with two rows of large oval beads, fewer than the costae.

Length 0.165; width (median) 0.031; costae 5 in 0.01 mm.; dorsal beads 3.2 in 0.01 mm.

This diatom is related to *A. egregia* Ehrenberg, especially as figured in Diatoms of France, plate 46, figure 12, and resembles somewhat *A. praevalida* Janisch (Janisch, Gaz. Exp., pl. 20, fig. 21).

Type.—Cat. No. 43570, U.S.N.M.

AMPHORA COMPACTA, new species

Plate 3, fig. 6

Dorsal side of valve flat for three-quarters of its length or barely reflexed at the middle, curved to the very blunt ends; ventral side slightly biconvex, indented at the middle, the ends having small hyaline "ear lobes" below the ventral edge; rhaphe slightly double-bowed, its central and terminal nodules adjacent to the ventral edge; no hyaline area; markings transverse, very closely set, slightly wavy; costae obscurely cross-striated.

Length, 0.144; width, 0.028; lines, 7.2 in 0.01 mm.

A plump, robust form, simulating some of the insect larvae.

Type.—Cat. No. 43571, U.S.N.M.

AMPHORA CORPULENTA Cleve and Grove

(Le Diat., vol. 1, p. 68, pl. 10, fig. 14.)

This species is common in the Philippine Islands. The original was found at the not far distant Macassar Straits.

AMPHORA COSTATA W. Smith

(Smith, Brit. Diat., pl. 30, fig. 253.)

I do not agree with Cleve's idea of this being like *A. cymbifera* Gregory the same as *A. erebi* Ehrenberg (Mikrogeologie, 35A, pl. 23,fig.2). This last is practically indeterminate and came from the Arctic, namely, Assistance Bay. Gregory's form is figured in Diatoms of the Clyde, plate 14, figure 97.

AMPHORA CRASSA Gregory

(Geogory, Diat., Clyde, p. 524, pl. 14, fig. 94; Schmidt, Atlas, pl. 28, fig. 16.)

Many varieties of this inconstant species were found, including the form peculiar to Campeche Bay and called by Grunow, var. *campechiana.*

AMPHORA CUCUMERIS, new species

Plate 3, fig. 7

Valve stout, almost cylindrical, with blunt ends which are only slightly bent toward the ventral (rhaphe) side; convex on the dorsal side, the ventral barely convex or straight except for a shallow sinus at the middle; markings coarse longitudinal rows of heavy beads, six to seven rows, the space between the two median ones wider than between the others, thus producing a longitudinal, median hyaline line; rhaphe in general parallel with the ventral margin. No complete frustule was found; hence the character of the connecting zone is not known.

Length, 0.092; width, 0.026; rows of beading, 3.6 in 0.01 mm.; beads in each row, 3 in 0.01 mm.

This very stout diatom with its valves curiously like the rough cucumber known as the gherkin, belongs to the group of *Amphoras* of which *A. crassa* Gregory is the type. It can not, however, be assigned to any hitherto described species. It is rare in the Philippines.

Type—Cat. No. 43572 U.S.N.M.

AMPHORA CYMBIFERA Gregory

(Gregory, Diat., Clyde, p. 526, pl. 14, fig. 97; Schmidt, Atlas, pl. 25, figs. 17–19.)

Cleve in his Naviculoid Diatoms (vol. 2, p. 122) places this and *A. costata* W. Smith (Smith, Brit. Diat., 1853, pl. 30, fig. 253) under *A. terroris* Ehrenberg (as named in Abh. Berl. Akad., 1853, p. 526, and figured in Ehrenberg, Mikrogeologie, 35A, pl. 23, fig. 2, also in Lens, p. 83, pl. 3, fig. 20) and makes a correction in the text of Ehrenberg's Mikrogeologie, giving figure 2 instead of figure 3 for *A. terroris* and figure 3 for *A. erebi* Ehrenberg. De Toni, taking the uncorrected figures in the foregoing, unites *A. costata* W. Smith with figure 2, *A. erebi*, but keeps Ehrenberg's Mikrogeologie, plate 25A, section 23, figure 3 separate, calling it *A. terroris* (Syl. Alg., pp. 287 and 418). The figure of Gregory and that of W. Smith do not agree, especially in the outline of the valve on its ventral side. It is best to keep these forms separate, as similar but not identical, particularly as H. L. Smith states that he and Professor Gregory have compared notes on the structure of the Gregory specimen and the figure of W. Smith's species and find them to be different. My specimens agree accurately with Gregory's figure and description.

AMPHORA DEDUCTA A. Schmidt

(Schmidt, Atlas, pl. 25 fig. 13.)

My specimen agrees exactly with the above, but it is doubtful if it can be held separate from *A. angusta* Gregory (Schmidt's Atlas, pl. 25, fig. 14).

AMPHORA DICHOTOMA, new species

Plate 4, fig 1

Dorsal side of valve strongly convex for three-quarters its length, thence to the broad and blunt ends only slightly so; ventral side strongly concave for three-quarters its length, with an arc parallel to that of the ventral side, then curving upward to the ends; rhaphe having its center nodule adjacent to the ventral edge, then curving upward and ending in two strong terminal nodules at the ends and close to the upper, dorsal side; a large hyaline area about the central nodule; marking above the rhaphe of coarse but misty, radiating, and curved costae, thicker on the dorsal side and tapering to fine dichotomous ends next to the rhaphe; below the rhaphe (ventral side) the costa are finer, indistinct, and curved away from the center.

Length, 0.095; width, 0.028; lines, 6 in 0.01 mm., measured on the median dorsal side.

This species belongs to that group of this large genus the type of which is *A. spectabilis* Gregory, especially as figured in Diatoms of France, plate 48, figure 8.

Type.—Cat. No. 43573, U.S.N.M.

AMPHORA DURA, new species

Plate 4, fig. 2

Dorsal side with a sharp median indentation in which is a single large bead, the dorsal edge being barely convex to within one-sixth of the ends, then curved smoothly down to the ventral edge; ventral side slightly biconcave; rhaphe starting from a strong central nodule, arched upward on both sides and terminating in two large spherical nodules set at the sharp apices of the ends on the central side; an indistinct hyaline stauros across the valve from the dorsal bead to the central nodule; closely set coarse vermiform markings over the entire valve.

Length, 0.124; width, 0.023 mm.; no transverse lines.

Although this form is near *A. obtusa* Gregory, the massive bead on the dorsal side and the constant vermiform markings give it more than varietal rank. It is related to *A. delphinia* Bailey, as figured in Schmidt's Atlas, plate 40, figures 24–27. It is abundant in all Philippine Islands gatherings and is uniform in appearance.

Type.—Cat. No. 43574, U.S.N.M.

AMPHORA EGREGIA Ehrenberg

(Schmidt, Atlas, pl. 28, figs. 13–15.)

All my specimens are of the Campeche Bay variety, as mentioned in the above reference.

AMPHORA EXSECTA Grunow

(Janisch, Gaz. Exp., pl. 21, fig. 2; Schmidt, Atlas, pl. 27, fig. 55, not fig. 54.)

AMPHORA FLEXA, new species

Plate 4, fig. 4

Dorsal side of the valve smoothly bent at the middle, barely convex to the narrow ends; ventral side even less strongly concave; ends small, evenly rounded; rhaphe close to the ventral edge, slightly double-bowed; a large hyaline central area extending across the valve from the central nodule on the ventral edge to near the dorsal side, where there are short rows of beads; markings of loosely set rows of beads radially arranged, parallel, with interspaces as wide as the rows, none transverse.

Length 0.118; width 0.024; lines 8 in 0.01 mm., measured on the dorsal side.

It bears a slight resemblance to *A. scabriuscula* Cleve and Grove (Le Diat., vol. 2, pl. 3, fig. 7). A variety occurs with the beads somewhat unevenly placed in the different rows, thereby giving a wavy appearance to the marking.

Type.—Cat. No. 43575, U.S.N.M.

AMPHORA FORMOSA Cleve

(Schmidt, Atlas, pl. 28, fig. 34 and pl. 39, fig. 2.)

AMPHORA FURCATA Leuduger-Fortmorel

(Leuduger-Fortmorel, Diat., Ceyl., p. 20, pl. 1, fig. 11; Schmidt, Atlas, pl. 40, figs. 19–23, misnamed.)

This delicate diatom with remarkably forked lines upon the dorsal side, whence its name, is referred by Schmidt to *A. spectabilis* Gregory, which is similar in outline only, as may be seen from his description in Diatoms of the Clyde, page 516, and the figure on plate 13, figure 80.

AMPHORA FUSCA A. Schmidt

(Schmidt, Atlas, pl. 27, fig. 68.)

The original was from the Gulf of Mexico.

AMPHORA GIBBA A. Schmidt

(Schmidt, Atlas, pl. 39, fig. 32.)

The specimens found were of the Campeche Bay type.

AMPHORA GIGANTEA Grunow

(Schmidt, Atlas, pl. 27, fig. 46.)

This is also a Campeche Bay diatom found at the Philippine Islands.

AMPHORA GRAEFFEI Grunow

(Schmidt, Atlas, pl. 25, figs. 40, 42.)

AMPHORA GREVILLEANA Gregory

(Schimid, Atlas, pl. 25, fig. 41.)

AMPHORA GRUNDLERI Grunow

(Schmidt, Atlas, pl. 28, figs. 24–27, and pl. 39, fig. 25.)

The original of this was also from Campeche Bay.

AMPHORA HENSHAWII, new species

Plate 3, fig. 8

Dorsal side with a small shallow median sinus, which is otherwise strongly convex to the slightly enlarged rounded ends; ventral side nearly straight, barely concave; rhaphe parallel to the ventral edge but removed from it by a narrow hyaline space, not reflexed at the ends; markings of massive, well separated, smooth costae, transverse at the middle of the valve, increasingly radial and slightly curved toward the ends, reaching to the rhaphe, but leaving the hyaline band above mentioned along the ventral edge; this edge marked with a single row of fine beads.

Length 0.072; width 0.017; lines 6 in 0.01 mm., measured on the dorsal side.

This species resembles the questionable variety *subconstricta* Grunow of *A. lineata* Gregory, a fresh-water form figured in Diatoms of the Caspian Sea, plate 3, figure 5, but has relatively much coarser markings and blunter ends. The true *A. lineata* is a widely different form, and is given in Diatoms of the Clyde, page 512, plate 12, figure 70. It also slightly resembles *A. philippinica* Castracane (Chall. Exp., pl. 27, fig. 2), which on account of its original locality being identical with that of this form, deserves consideration; but Castracane's species is much narrower, has "apices that are very prolonged, sharp and slightly bent" and "striis transversis perspicuis punctulatis." The two, therefore, can not be confused.

It is named in honor of Mr. Henry W. Henshaw, who found the first specimen.

Type.—Cat. No. 43576, U.S.N.M.

AMPHORA HYALINA Kützing

(Schmidt, Atlas, pl. 26, figs. 52–55; H. L. Smith, Types, No. 614.)

AMPHORA INFLATA Grunow

(Schmidt, Atlas, pl. 25, figs. 29–30.)

The original of this also was from Campeche Bay.

AMPHORA INTERSECTA A. Schmidt, var.?

Plate 5, fig. 6

(Schmidt, Atlas, pl. 25, figs. 37–38.)

I give a figure of what may be a coarse variety of the above species. The differences hardly warrant a separate name, but Schmidt's specimens from Baltschick are not only much finer, but also somewhat different on the ventral side. It may be found necessary to rename this more robust form, in which case it could be called *Amphora interrupta*, new species.

AMPHORA LUNARIS, new species

Plate 4, fig. 5

Valve lunate, the dorsal side a strongly convex arc, the ventral strongly concave except for a slight convexity at the middle; ends narrow, rounded, barely swollen; rhaphe adjacent to the ventral edge except toward the ends; its two terminal beads touching the margin of the ends; markings of closely set transverse rows of elongated beads, so spaced as to form a tessellated pattern.

Length 0.158; width 0.050; lines 5 in 0.01 mm., measured on the dorsal side.

Resembles slightly *A. virgata* Ostrup (Ostrup, Diat., N. E. Groenland, pl. 13, fig. 12).

Type.—Cat. No. 43577, U.S.N.M.

AMPHORA MAGNIFICA Greville

Plate 5, fig. 4

(Greville, So. Pac. Diat., p. 575, pl. 4, fig. 1; Lens, pl. 1, fig. 8.)

AMPHORA MILESIANA Gregory

(Gregory, Diat., Clyde, p. 49, pl. 5, fig. 83; Lens, pl. 1, fig. 7.)

AMPHORA MONILIFERA Gregory

(Gregory, Diat., Clyde, pl. 12, fig. 69.)

AMPHORA NODOSA, Brun, variety

Plate 5, fig. 3

(Brun, Espec. Nouv., pl. 12, fig. 2.)

AMPHORA OBESA Cleve and Grove

(Le Diat., pl. 22, fig. 8.)

A variety of this diatom was incorrectly named by me *A. honshuensis* Mann, in my Diatoms of the Albatross Voyages, plate 44, figure 1.

AMPHORA OBTUSA Gregory

(Micr. Journ., vol. 5, pl. 1, fig. 34; Schmidt, Atlas, pl. 40, figs. 4–7, 11, and 16–17.)

With several varieties, including var. *oceanica* Castracane.

AMPHORA OCELLATA Donkin

(Micr. Journ., 1861, p. 11, pl. 1, fig. 11*b*; Van Heurck, Synopsis, pl. 1, fig. 26.)

Including the var. *cingulata* Cleve.

AMPHORA OCULUS A. Schmidt

(Schmidt, Atlas, pl. 27, fig. 52.)

The type was from the near by Bay of Yokohama.

AMPHORA OSTREARIA, var, VITREA Cleve

(Peragallo, Diat., France, pl. 49, figs. 14–15.)

AMPHORA OVALIS Kützing

(Smith, Brit. Diat., pl. 11, fig. 26; Schmidt, Atlas, pl. 26, figs. 106–111; H. L. Smith, Types, No. 40.)

This generally common diatom is rare in the Philippine Islands.

AMPHORA PAUCA, new species

Plate 4, fig. 6

Valve long, narrow, straight, with rounded ends, having obscure "ear lobes" on the ventral side; rhaphe adjacent to and parallel with the ventral side, its ends only slightly enlarged and barely reflexed; markings of strong, smooth costae, transverse except at the middle of the valve, where one or two pairs form a V-shaped figure; a hyaline line bisects all the costae; traversing the entire length of the valve.

Length, 0.195; width, 0.023; lines, 4.1 in 0.01 mm.

The nearest known forms are in Schmidt's Atlas, plate 28, figure 17, and plate 39, figure 27, both unnamed.

Type.—Cat. No. 43578, U.S.N.M.

AMPHORA PECTEN Brébisson

(Brun, Espec. Nouv., pl. 12, fig. 4.)

AMPHORA PERMAGNA Pantocsek

(Pantocsek, Hung. Diat., vol. 2, pl. 6, fig. 113.)

AMPHORA POLYGONATA Castracane

(Castracane, Chall. Exp., pl. 27, fig. 8.)

This form can not be admitted to be a variety of Castracane's *A. polygonata* (figured in Chall. Exp., pl. 27, fig. 8) if that author's descriptions and figures are to be trusted; in which case, this form agreeing with his figure 8 should have a new name.

AMPHORA PRAEVALIDA Janisch

(Janisch, Gaz. Exp., pl. 20, fig. 21.)

Cleve (Nav. Diat., vol. 2, p. 110) places this under *A. pecten* Brun, a very much coarser and altogether different diatom (figured and described in Brun, Espec. Nouv., p. 9, pl. 12, fig. 4). I have both from the Philippine Islands and their union is impossible. This species is much closer to *A. scalaris* Castracane (Chall. Exp., p. 18, pl. 27, fig. 19) from which it differs only by the heavy border on the ventral side of the latter.

AMPHORA PRISMATICA Cleve

(Cleve, Nav. Diat., vol. 2, pl. 4, fig. 26.)

AMPHORA PROTEUS Gregory

(Gregory, Diat., Clyde, p. 518, pl. 13, fig. 81; Schmidt, Atlas, pl. 27, figs. 2–3, 5–6.)

AMPHORA PULCHRA Greville

Plate 5, fig. 1

(Greville, So. Pac. Diat., p. 575, pl. 4, fig. 2; Cleve, Nav. Diat., vol. 1, p. 20, pl. 2, fig. 23.)

This diatom is placed erroneously in the genus *Auricula* by Cleve in the above reference. This error is doubtless due to not studying the face view, of which there seems to be no illustration, and for which one is here supplied. It will be seen at once that this belongs where Greville placed it, in the genus *Amphora*. Indeed, the girdle view looks more like *Amphiprora* than like *Auricula*.

AMPHORA RECESSA, new species

Plate 5, fig. 2

Dorsal side of valve slightly and evenly convex, ventral slightly biconcave; ends narrow, rounded; rhaphe double-bowed, generally parallel to the ventral edge, its outer ends thickened but without beads and not reflected; markings of fine closely set moniliform costae along the dorsal side, but leaving a hyaline space of equal width along the ventral side, except at the middle, where a wedge-shaped extension reaches nearly to the central nodule; girdle (back) marked with two to three very delicate longitudinal, widely separated lines of beading.

Length, 0.155; width, 0.020; width of frustrule, 0.056; lines, 9 in 0.01 mm.

This delicate species belongs in the *A. proteus* group. It has some resemblance to one shown in Schmidt's Atlas, plate 27, figure 37, and plate 27, figure 65, two varieties of *A. pellucida* Gregory.

Type.—Cat. No. 43579, U.S.N.M.

AMPHORA RECTANGULARIS Greville

(Greville, So. Pac. Diat., pl. 2, fig. 10.)

AMPHORA RHOMBICA Kitton

(Schmidt, Atlas, pl. 40, fig. 39.)

AMPHORA SCHMIDTII Grunow

(Schmidt, Atlas, pl. 28, fig. 3.)

The original of this species was from Campeche Bay.

AMPHORA SIMA, new species

Plate 5, fig. 5

Valve plump, massive, smoothly convex on dorsal side and biconvex on the ventral side; ends blunt, reflexed, flattened; rhaphe closely adjacent to the ventral edge; markings of heavy transverse costae without cross-striation, but having a single bead in the middle of each costa, the beads thereby forming a median line bisecting the valve longitudinally.

Length, 0.195; width, 0.043; lines, 3.5–4 in 0.01 mm.

Type.—Cat. No. 43580, U.S.N.M.

A. labuensis Cleve (Vega Diat., p. 493, pl. 35, fig. 1*b*) is a close relative of this, but its costae are striated, and lack the median row of beads, the ends also are not flattened and reflexed like the present species. There is some relation between it and *A. areolata* Grunow (Le Diat., pl. 22, figs. 1–4).

AMPHORA TUMULIFER, new name

Plate 4, fig. 3

Valve elongated, massive, dorsal side consisting of six strong sinuations; ends blunt and rounded, not incurved; ventral side double-bowed, with a shallow depression at the center; markings of coarse, transverse, somewhat wavy, moniliform lines, extending from the dorsal side across the rhaphe to the ventral side; the rhaphe approaching the ventral side at the center and ends, each half slightly bowed upward toward the dorsal side.

Length, 0.065; width, 0.016; lines, 10.3 in 0.01 mm.

This diatom is well illustrated in Schmidt's Atlas, plate 25, figure 80, but is misnamed *A. sarniensis* Greville, with however a question mark. It can not be united with that species (see the original in Micro. Journ., 1862, pl. 9, fig. 12, a figure well reproduced in Schmidt's Atlas, pl. 25, fig. 73). Fricke's Index repeats this name, but also questions it. Cleve (Nav. Diat., vol. 1, p. 120) unites this with figures 78–79 of Schmidt's Atlas, same plate, making it a new species, *A. tetragibba* Cleve, an impossible combination. De Toni (Syl. Alg., p. 394) prefers to join figures 78–79 with *A. sinuata* Greville, which is at least admissible. (See also Greville, So. Pac. Diat., pl. 2, fig. 5, and H. L. Smith, Lens, p. 81, pl. 3, fig. 8.) *A. sinuata* has a straight rhaphe about equidistant from the ventral and dorsal side, different ends and no such coarse lines as this species. H. L. Smith writes that they are "obscure." *A. dorsalis* Cleve and Grove (Le Diat., vol. 1, pl. 32, fig. 15) resembles this species slightly, but the description (p. 158) shows that the resemblance is only superficial. Its nearest relative seems to be *A. camelus* Cleve and Grove, when seen in the position shown in Le Diatomiste, volume 1, plate 22, figure 12.

AMPHORA TURGIDA Gregory

(Gregory, Diat. Clyde, pl. 12, fig. 63; Schmidt, Atlas, pl. 25, figs. 22–23, 27–28, 31.)

AMPHORA WEISSFLOGII A. Schmidt

(Schmidt, Atlas, pl. 25, figs. 58–59.)

Genus ANISODISCUS Grunow

ANISODISCUS ADEEI, new species

Plate 6, fig. 1

Valve circular, nearly flat; a central circular hyaline area, about one-third the radius, surrounded by an area of slightly greater width, ornamented by beads widely set apart with equal spacing, but presenting only an indistinct radial arrangement; this in turn surrounded by an outer area, about one-half the radius, ornamented with 18 to 24 radiating rows of double beads; interpolated between these near the margin an equal number of shorter rows of double beads, 6 to 7 pairs of beads in length, alternating with the long double rows; adjacent to the margin 18 to 24 small but evident semicircular processes, in some specimens at the ends of the long radiating rows; in others at the ends of the shorter interpolated rows.

Diameter 0.056 to 0.086 mm.

This beautiful diatom owes its delicate appearance to the fineness of its beading and the artistic lace open-work pattern of its arrangement. I have named it in honor of the late Hon. Alvey A. Adee, Assistant Secretary of State, whose skill as a photographer of the diatoms was of exceptional quality.

The species clearly belongs with *Stictodiscus kossuthii* Pantocsek (Hung. Diat., vol. 3, pl. 26, fig. 395) and *Actinodiscus horologium* Brun (Le Diat., pl. 23, fig. 13). But no *Stictodiscus* has the terminal semicircular elevations of the Pantocsek form, and *Actinodiscus* is especially distinguished by sharp radiating ridges, terminating at the margin in ocelli or pseudonodules; so that both of these assignments are untenable. My specimens are especially unlike *Stictodiscus* in not being evenly convex. As no complete frustule was found, the dissimilarity of the two valves, referred to in the generic name, could not be noted. But as several specimens were found showing variation in the radiating lines of beads, this characteristic may be assumed to belong to the present species.

Type.—Cat. No. 43581, U.S.N.M.

Genus ARACHNOIDISCUS Ehrenberg

ARACHNOIDISCUS EHRENBERGII Bailey

(Smith's Brit. Diat., pl. 31, fig. 256; Schmidt, Atlas, pl. 68, fig. 1.)

Genus ASTEROLAMPRA Ehrenberg

ASTEROLAMPRA MARYLANDICA Greville

(Micro. Journ., 1860, pl. 2, figs. 14–15; pl. 3, figs. 1–4.)

ASTEROLAMPRA PRINCEPS Rattray

(Rattray, Rev. Cosc., p. 644; Castracane, Chall. Exp., pl. 5, fig. 5.)

My specimen has a diameter of 0.141 mm., and 26 rays.

ASTEROLAMPRA VAN HUERCKII Brun

(Brun, Espec. Nouv., p. 10, pl. 14, fig. 1.)

A typical specimen of this large and delicate diatom.

Genus ASTEROMPHALUS Ehrenberg

ASTEROMPHALUS ARACHNE (Brébisson) Ralfs

(Pritchard, Inf., pl. 5, fig. 66; Schmidt, Atlas, pl. 38, figs. 3–4.)

ASTEROMPHALUS AREOLATUS, new species

Plate 6, fig. 5

Valve slightly oval, the long axis coincident with the single dissimilar radial arm. Seven arms in all, six of them broad, tapering to the margin, with a very minute process at the marginal end, separated by zig zag partitions where they join to form the central area, which is one-third the diameter of the valve; the dissimilar arm very narrow with a large process at its marginal end, its club-shaped inner end passing beyond the center of the valve; beading very coarse, not reticulated, the beads well separated, those bordering the arms larger than the others, two to three beads wide at the inner end and six to seven at the marginal end of each sector.

Long diameter, 0.045 mm.

This minute species has a general likeness to *A. reticulatus* Cleve (Diat. Java, p. 5, pl. 1, fig. 2). It is, however, not reticulated, its arms are dissimilar in shape and do not stop short of the margin but touch it, where there are small but evident processes at the tips, apparently lacking in Cleve's form. It is closer to the unnamed figure in Schmidt's Atlas, plate 38, figure 9, one specimen found being identical with that figure. It is not rare in the Philippine Islands dredgings, but its minuteness and delicacy make it difficult to find. Less similar is *A. robustus* Castracane (Accad. Pont. Nuovi Lincei, 1875, pl. 6, fig. 5).

Type.—Cat. No. 43582, U.S.N.M.

ASTEROMPHALUS BEAUMONTII Ehrenberg

(Schmidt, Atlas, pl. 38, figs. 6–7, misnamed. Fricke's index, p. 15.)

The correct name is indicated by the opinion, cited in the above, by Janisch. (See Mann, Diat. Alb. Voyages, p. 274.)

ASTEROMPHALUS BROOKEI Bailey

(Amer. Journ. Sci., 1856, p. 2, pl. 1, fig. 1; Schmidt, Atlas, pl. 38, figs. 21–23.)

ASTEROMPHALUS ELEGANS Greville

(Quart. Journ. Micro. Sci., 1859, pl. 7, fig. 6; Schmidt, Atlas, pl. 38, figs. 1–2.)

ASTEROMPHALUS HILTONIANUS (Greville) Ralfs

(Rattray, Rev. Cosc., p. 213; H. L. Smith, Types, No. 49.)

ASTEROMPHALUS RETICULATUS Cleve

(Cleve, Java Diat., p. 5, pl. 1, fig. 2.)

ASTEROMPHALUS ROPERIANUS (Greville) Ralfs

(Schmidt, Atlas, pl. 38, fig. 15; Micro. Journ., 1860, pl. 4, fig. 14.)

Genus AULACODISCUS Ehrenberg

AULACODISCUS KINKERI A. Schmidt

(Schmidt, Atlas, pl. 106, figs. 4–5.)

It is very questionable if Rattray's uniting this as a variety with *A. margaritaceus* Ralfs is an advantage (see Rattray, Rev. Aulaco., p. 352).

AULACODISCUS MACRAEANUS Greville

(Micro. Journ., 1862, pl. 2, fig. 4; Schmidt, Atlas, pl. 104, fig. 2.)

AULACODISCUS MARGARITACEUS Ralfs

(Schmidt, Atlas, pl. 37, figs. 4–5; pl. 104, figs. 7–8; pl. 105, figs. 1, 2, 4.)

AULACODISCUS ORIENTALIS Greville

(Micro. Journ., 1864, pl. 2, fig. 6; Schmidt, Atlas, pl. 34, figs. 1, 3.)

Although the type of this species is clearly different from *A. oregonus* Harvey and Bailey, a perfect series of intermediate forms bridges the gap between the two.

AULACODISCUS PRETIOSUS, new species

Plate 6, fig. 2

Valve circular, having a round hyaline central area from which proceed about 11 radial lines bordered by single rows of fine, closely set beads; each hyaline line broadening at the margin into a small circular space, in the center of which is placed a minute sessile hemispheriod process; the rows of beading between the radii generally parallel to within one-third of the margin, then converging toward the central row; the short secondary rows are suddenly multiplied around the outer one-quarter of the radius of the valve, the beading being smaller as it becomes more crowded, so that the outer one-quarter appears as an external band; the center of every bead is marked by a minute dot or prickle; the surface of the valve is nearly flat, the central part barely depressed, and the areas between the eleven marginal processes only slightly concave.

Diameter, 0.129 mm.

The nearest species are those shown in Schmidt's Atlas (pl. 107, fig. 6) *A. oregonus*, var. *sparsus-punctata* Grunow and (pl. 107, figs. 5–6) *A. voluta coeli* Brun.

Type.—Cat. No. 43583, U.S.N.M.

AULACODISCUS RECEDENS, new species

Plate 6, fig. 3

Valve circular, flat to within one-fifth of the margin, thence curving rapidly downward; a hyaline central area one-sixth the radius in diameter, from which proceed eight broad, hyaline radii to within one-fifth of the margin, where they slightly expand around eight strong, round, slightly protuberant processes; the rows of large, widely spaced beads bordering the eight radii are perfectly straight, the other rows in each of the eight sectors being parallel to the median row; no crowding of beads toward the margin.

Diameter, 0.070 mm.

The large, widely spaced beading of this species, its flat surface surrounded by a rapidly depressed outer band, and the strongly recessed circle of processes give to it a unique appearance.

It resembles somewhat *A. amoenus* Greville (Schmidt, Atlas, pl. 34, fig. 6) and more closely the unnamed figure in Schmidt's Atlas, plate 133, figure 7.

Type.—Cat. No. 43584, U.S.N.M.

Genus AULISCUS Ehrenberg

AULISCUS CAELATUS Bailey

(Smith. Contrib., 1854, p. 6, figs. 3–4; Schmidt, Atlas, pl. 32, figs. 14–15)

The type form and a large number of varieties were found including var. *delicatula* Rattray (Rev. Auliscus, p. 886, pl. 15, fig. 5) and var. *latecostata* A. Schmidt, (Atlas, pl. 32, figs. 16–20) the latter being a Campeche Bay form.

AULISCUS COMPOSITUS A. Schmidt

(Schmidt, Atlas, pl. 30, fig. 9.)

AULISCUS PHILIPPINARUM, new species

Plate 6, fig. 4

Valve slightly oval, long axis passing slightly to the left and right of the two processes; central hyaline area large, somewhat rectangular; two processes (ocelli) of moderate size, strongly ringed, tilted obliquely outward, set close to the margin on two wedge-shaped elevations, which are coarsely rugose with irregular-shaped beads; the rest of the valve ornamented loosely with curved strings of heavy beading radiating from two club-shaped areas which extend from the central area right and left to within a short distance of the margin; valve and all markings massive and glistening.

Long diameter, 0.082–0.159.

This spectacular diatom is abundant in the Philippines. It is very nearly the same as one figured in Le Diatomiste (p. 2, pl. 2, figs. 4–5) but misnamed *A. oamaruensis*, var. *madagascarensis* Tempère and Brun. It has some resemblance to *A. hardmanianus* Greville, including the fossil form from Monterey, Calif., and especially as it is figured in Schmidt's Atlas, plate 89, figure 4, from a Santa Monica, Calif., specimen, also fossil. But to unite this clearly distinct and constant form with either of the above fossil species would be unwise.

Type.—Cat. No. 43585, U.S.N.M.

AULISCUS QUADRATUS, new species

Plate 7, figs. 1–2

Valve slightly oval, its long axis about 45° right and left from the two ocelli; these large, sessile, with elevated and rugose centers; the entire valve, except a small hyaline circular central area, covered with a network of anastomosing lines, but in a large square occupying the middle of the valve these lines are either obscure or sometimes absent, so that this square is sharply defined from the rest of the valve.

Diameter, 0.101–0.107 mm.

Type.—Cat. No. 43586, U.S.N.M.

AULISCUS RETICULATUS Greville

(Micro. Journ., 1863, pl. 2, fig. 4; Schmidt, Atlas, pl. 30, figs. 1–3.)

AULISCUS SCHMIDTII Grundler

(Schmidt, Atlas, pl. 30, fig. 7.)

AULISCUS STOCKHARDTII Janisch

(Janisch, Guanos., pl. 1, fig. 4; Schmidt, Atlas, pl. 30, figs. 11–13; pl. 67, fig. 6.)

This species occurs in a large number of fossil deposits that are widely separated, New Zealand, California, Hungary, Bolivia, etc., but is rare as a living form. It may be looked upon as a hold over.

Genus AURICULA Castracane

AURICULA INSECTA Grunow

(Schmidt, Atlas, pl. 40, figs. 2–3.)

AURICULA JAPONICA Brun

(Brun, Diat. Jap., pl. 4, fig. 8.)

AURICULA OSTREA Brun

(Brun, Diat. Jap., pl. 4, fig. 7.)

Genus BIDDULPHIA Gray

BIDDULPHIA ABJECTA, new species

Plate 7, figs. 3–4.

Valve triangular, with slightly concave sides; apices ending in blunt subsessil rings; a few scattered beads, closely but irregularly set, form a curved line crossing each of the angles; the middle part of the valve quite hyaline, except for a few coarse blotches along the sides; these curve downward to form the deep triangular half box which, united with the corresponding other half by the girdle, makes the frustule. In side (girdle) view the three apices are seen to be very blunt, with a hemispherical end, back of which is the curved line of irregular beads above mentioned. The outer part of the apices running vertically down from the three processes to the girdle are buttressed by a slight fold or extension of the valve; the vertical sides of the valve (between the three apices) are scantily marked with small irregular beads or blotches.

Diameter 0.0612 mm., depth of valve (face to girdle line) 0.030 mm.

Type.—Cat. No. 43587, U.S.N.M.

BIDDULPHIA ANTILLARUM (Cleve) Boyer

(Cleve, Diat., W.I., pl. 5, fig. 29; Schmidt, Atlas, pl. 99, fig. 14.)

De Toni resurrects for this and a few other unmistakable Biddulphiae Ehrenberg's impossible genus, *Amphipentas*, stressing the accidental five-angled form of some individuals that differ in no other respect from those in the same gathering having three or four angles, a process that reduces the concept, species, to an absurdity. Some examples, besides the above, are his *A. quinquelobata, A. godeffroyi, A. campechiana,* and the unimportant variety of *Trigonium arcticum* (Brightwell) Cleve, which is called *Triceratium cyclamen* Brun in Schmidt's Atlas (pl. 165, fig. 5). (See De Toni, Syl. Alg., p. 910.)

BIDDULPHIA AURITA (Lyngbye) Brébisson

(Smith, Brit. Diat., pl. 45, fig. 319; Van Heurck, Synopsis, pl. 98, figs. 4–9.)

A number of varieties of this inconstant and prolific species was found.

BIDDULPHIA BALAENA (Ehrenberg) Brightwell

See *Trigonium balaena* (Ehrenberg) Cleve.

BIDDULPHIA BALEARICA (Cleve and Grunow) Mann

(Cleve, New and Little Known Diatoms, pl. 6, fig. 73; Schmidt, Atlas, pl. 97, figs. 20, 21.)

The *reductio ad absurdum* of De Toni's assignments of certain forms to "*Amphipentas,*" mentioned under *B. antillarum* above, is his placing two figures of this species (Schmidt, Atlas, pl. 98, fig. 20) in *Amphitetras* and (pl. 98, fig. 21) in *Amphipentas.*

BIDDULPHIA BICORNIS Cleve

See under *B. dubia* (Brightwell) Cleve

BIDDULPHIA BIROSTRUM Brun

(Brun, Espec. Nouv., p. 11, pl. 12, fig. 10.)

This has rather close resemblance to *B. aurita*

BIDDULPHIA BROECKII (Leuduger-Fortmorel) Mann

(Schmidt, Atlas, pl. 82, figs. 10, 12, 13.)

The spelling of the specific name *brookei* by Schmidt is incorrect.

BIDDULPHIA CAMPECHIANA (Grunow) Boyer

(Cleve, Diat., W. I., p. 16, pl. 5, fig. 28.)

As the name indicates, this is another Campeche Bay species.

BIDDULPHIA CASTELLIFERA (Grunow) Mann

(Schmidt, Atlas, pl. 128, figs. 8, 17–18.)

BIDDULPHIA CINGULATA, new species

Plate 7, figs. 5–6

Valve broadly elliptical with pointed ends; the rim (the margin which joins the girdle of the frustule) is undulating, and marked with delicate, widely separated cross lines; the central part of the valve, raised above the rim, is ornamented with orderly rows of beads running longitudinally but converging toward the bases of the two horns that arise at the ends of this elevated central part of the valve; a broad band bounded by a delicate hyaline line crosses the valve transversely, with a strong erect spine set near each end of it, a fine hyaline line connects the two spines and thus bisects the band; in side (or girdle) view each valve shows two very long outwardly curving hyaline horns, their globular ends bent outward; the undulating rim extends beyond the rest of the valve, which is separated from it by a narrow hyaline space and is rounded out on each side into two "cheeks." In some specimens the beading is sparsely sprinkled with fine prickles, best seen in side view. The girdle is narrow and covered with closely set rows of transverse beading.

Length of valve (including rim), 0.082 to 0.169 mm.; width, 0.056 to 0.135 mm.; height of frustule, with horns, 0.110 mm.

Type.—Cat. No. 43588, U.S.N.M.

BIDDULPHIA CONCAVA, new name

(Schmidt, Atlas, pl. 84, fig. 17, misnamed.)

This evident *Biddulphia* is well illustrated in the above reference, where it bears the name *Triceratium japonicum* A. Schmidt. Its transfer to *Biddulphia* with that specific name is impossible because of *B. japonica* Castracane (Challenger Exp., pl. 23, fig. 14) *Triceratium concavum* Bailey (Wilkes Exp., pl. 9, figs. 24–26) not being a true *Biddulphia,* but belonging to the genus *Trigonium,* would not affect the validity of the above name. This species has a merely general resemblance to *Biddulphia* (*Triceratium*) *scitula* (Brightwell). Schmidt's specimen came from the not far distant Yokahama, Japan.

BIDDULPHIA CONSIMILIS (Grunow) Boyer

(Van Huerck, Synopsis, pl. 108, fig. 2; Schmidt, Atlas, pl. 84, figs. 13–14, and pl. 84, fig. 17, misnamed.)

The only locality hitherto reported for this species is the fossil deposit at Santa Monica, Calif. The finding therefore of several unmistakable specimens in Philippine Islands dredgings is interesting.

BIDDULPHIA CORNIGERA, new species

Plate 8, fig. 2

Valve seen in face view broadly elliptical with pointed ends forming an obtuse angle, in which, close to the apices, arise two long horns; a circular or slighty oval central area represents about four-fifths to five-sixths of the surface of the valve and is slightly elevated above the part surrounding it, the line of separation being armed with an indefinite number of stout spines irregularly placed, sometimes grouped on one side, generally scattered along opposite sides; the rest of the valve thickly covered with short prickles; in side (or girdle) view the two long horns are seen to be divergent and to have enlarged bulbous ends, slightly pointed on the inner side; the rim (joining the girdle) is broad, hyaline, and extends beyond the sides of the valve; the girdle is covered with a fine rugose marking.

Length of valve, 0.046–0.124; width; 0.028–0.106 height of frustule; 0.073–0.096 mm.

The question of the identity of this species and *B. expedita* Janisch is an interesting but unsolvable one. Certain small specimens with wide girdles appear, if viewed obliquely, exactly like the sketchy figure of *B. expedita* given in his Diatoms of the Gazelle Expedition, plate 21, figure 7, and reproduced in Schmidt's Atlas plate 121 figure 3. But with no description, no direct side (girdle) view, and no knowledge of the shape and markings of the valves it is idle to attempt any conclusion. All diatomists know that two species of *Biddulphia* may closely resemble each other in one view and yet show marked distinctions in the other view. In fact certain frustules of the widely different diatom, *B. cingulata*, when slightly turned and seen in the girdle view, are equally like the crude figure of *B. expedita*.

It is most desirable, whenever possible, to have both the face and side views of the *Biddulphiae*. I am compelled to ignore the *B. expedita* of Jansich as indeterminate. This species is abundant in many of the Philippine dredgings. In valve view it somewhat resembles the fossil *B. oamaruensis* Grove and Sturt (Oamaru, Diat., p. 5, pl. 1, fig. 10).

Type—Cat. No. 43589, U.S.N.M.

BIDDULPHIA CORNUTA (Greville) Mann

(Micro. Journ., 1861, pl. 8, fig. 8; Van Heurck, Synopsis, pl. 108, figs. 12–13.)

BIDDUPLHIA CULCITELLA Mann

(Mann, Diat., Alb. Voyages, p. 300, pl. 46, fig. 3.

BIDDULPHIA CUSPIDATA (Janisch) Mann

(Schmidt, Atlas, pl. 84, figs. 2–3.)

The side (girdle) view of this species shows that the valve is flat, not convex, and that the areolation extends through the border. It can not be united with *B. favus* (Ehrenberg) Van Heurck, as is done by Boyer (Bidd. Forms, p. 706).

BIDDULPHIA CYCLOIDES, new species

Plate 8, fig. 1

Valve subcylindrical, with eight protruding processes, giving it an octagonal outline; surface slightly and evenly convex to the vertical sides, covered with radiating rows of beading, the beads scattered in the central part, becoming closer and more truly set in rows toward the margin; the eight processes blunt, nearly sessile, protruding beyond the margin; in side view the convex valve is seen to drop vertically down to the rim, the depth of the valve being somewhat less than one-third its diameter.

Diameter, 0.057 to 0.099 mm.; Depth of latter, 0.031 mm.

Although this diatom is not infrequent in Philippine dredgings no complete frustule was found and therefore the girdle can not be described.

The only published species at all similar to this is *Triceratium forresterii* Pantocsek (Le Diat., vol. 1, pl. 1, fig. 2). But this lacks the *Cerataulus* like horns at the angles and is not evenly convex. There is a slight similarity to be seen in *Cerataulus rotundus* Tempère and Brun (Le Diat., vol. 1, pl. 5, fig. 3).

Type.—Cat. No. 43590, U.S.N.M.

BIDDULPHIA DISCURSA, new species

Plate 8, fig. 3

Valve triangular, each side slightly distended until near the acute apices; central portion of valve convexly elevated; horns narrow, their basal portion dotted, not enlarged at the end; areolation a hexagonal network, somewhat crowded and irregular in the middle of the valve, becoming slightly larger toward the sides and regularly arranged in rows not radial but parallel to the sides, the outside row elongated toward the margin but not angled where its areolations touch the margin; this margin or rim is cross-marked with bars that are enlarged into beads at their outer ends; the secondary markings beneath the network consist of closely set beading in strictly radial arrangement; a single small but evident spine in the center of each hexagon. The name refers to the laterally parallel rows of the network contrasted with the radially arranged rows of the beading.

Diameter (from apex to middle of opposite side) 0.25 mm.; diameter of hexagons (average), 0.007 mm.; rows of beading (average), 13 in 0.01 mm.

This *B. favus*-like diatom has some resemblance to two other forms, *B.* (*Triceratium*) *broeckii* Leuduger-Fortmorel (Schmidt, Atlas, pl. 82, figs. 10, 12) and *B.* (*Triceratium*) *scitulum* Brightwell (Micro. Journ., 1854, pl. 4, fig. 9).

Type.—Cat. No. 43591, U.S.N.M.

BIDDULPHIA DISTINCTA (Janisch) Mann

(Schmidt, Atlas, pl. 83, fig. 1.)

BIDDULPHIA DUBIA (Brightwell) Cleve

(Micro. Journ., 1859, pl. 9, fig. 12; Schmidt, Atlas, pl. 78, figs. 32–35.)

I include with this Cleve's *Triceratium bicorne* (Schmidt, Atlas, pl. 78, figs. 24–25). The species has also close affinities with *Biddulphia reticulata* Roper, which almost justify their union.

BIDDULPHIA EXACTA, new species

Plate 9, fig. 1

Valve triangular, side slightly convex, apices not produced; processes nearly sessil, tilted outward; the entire surface covered with a large, strong-walled, hexagonal network arranged in exactly straight lines perpendicular to the three sides, the areolation only slightly smaller toward the margin; beneath the areolation are secondary markings of extremely minute beads, obscurely, if at all, radial in arrangement; a sharp slightly curved spine in the center of each hexagon; in side (or girdle) view the top of the valve is seen to be flat and closely set with the above-mentioned spines, the three horns protruding at an angle of 45° and the sides below these being recessed; the rim (adjacent to the girdle) extends beyond the tips of the horns: the girdle is broad and entirely covered with close beading, arranged in quincunx order.

This side view of the entire frustule is accurately figured in Schmidt, Atlas, plate 87, figure 6, and it is a proof of the keen observation of that author that he suspects this evidently solitary specimen brought to his attention to be a new species, but refrains from naming it. His specimen is marked as coming from the near-by North Celibes. In the Philippine Islands it seems also to be rare.

Diameter (apex to middle of opposite side) 0.144 mm.; height of frustule 0.107 mm.

Type.—Cat. No. 43592, U.S.N.M.

BIDDULPHIA EXPEDITA Janisch(?)

(Schmidt, Atlas, pl. 121, fig. 3.)

As to whether or not this is present in my Philippine Islands material is discussed under *Biddulphia cornigera,* new species.

BIDDULPHIA FAVUS (Ehrenberg) Van Heurck

(Mikrogeologie, pl. 19, fig. 17; Schmidt, Atlas, pl. 82, figs. 1, 3, 4.)

This very cosmopolitan diatom, both in recent material and fossil deposits, is represented in the Philippine Islands by the type form and many varieties. A variety that bears the name of *Triceratium scitulum* Brightwell, is well illustrated in the original figure (Micro. Journ., 1853, pl. 4, fig. 9, and Schmidt, Atlas (pl. 83, figs. 11–13 but not pl. 84, figs. 5–6), the latter being here given the new specific name *B. scitula* (A. Schmidt) Mann. Schmidt suggests the union of plate 83, figures 11–13, with *B. favus* as a variety, this being the true Brightwell form, but he does not include plate 84, figures 5–6.

BIDDULPHIA FIMBRIATA (Wallich) Mann

(Micro. Journ., 1858, pl. 2, figs. 4–9; Schmidt, Atlas, pl. 82, figs. 6–7.)

There is a general tendency to unite this with the former species. It is a much more delicate diatom with a different arrangement of the areolation next to the margin. In fact, the margin, seen in side (girdle) view, is wholly unlike that of *B. favus.* It may be remarked here that the side view in *Biddulphia* is too frequently neglected in descriptions and illustrations, although its significance is most valuable. This species is not to be confused with *Biddulphia fimbriata* Greville, which Grunow has rightly transferred to *Denticella* (Diat F. Jos. Land, p. 6).

BIDDULPHIA FRACTOSA, new species

Plate 8, fig. 5; plate 10, fig. 1

Valve triangular, elevated at the center, its sides slightly or strongly convex; horns at the three angles, stout, tapering, rugose to the tip, their ends even with the margin of the valve; markings of course beading, imperfectly radial in arrangement, loosely scattered over the central part, more compact near the margin; from the sides there run irregularly inward short cracklike depressed lines, two to five on each side, and occasionally a few short isolated ones near the center.

Diameter (apex to opposite side), 0.056–0.090 mm.

The general resemblance of this species to *Biddulphia* (*Triceratium*) *tabellarium* Brightwell, especially to its variety called *T. venulosum* Greville, is apparent. The powerful horns, however, make their union impossible. No girdle view of this species was obtainable·

Comparison may be made with *T. lineolatum* Greville (Micro. Journ., 1863, pl. 10, fig. 16) fossil at Barbados; also with the questionable variety of *T. areolatum* Greville figured in Walker and Chase, New Diatoms, plate 3, figure 13, practically identical with what Grunow calls *T. jensenianum* (Schmidt, Atlas, pl. 77, figs. 15–16). The typical *T. areolatum* Greville can be found in the Microscopical Journal for 1861, plate 8, figure 13.

Type.—Cat. No. 43593, U.S.N.M.

BIDDULPHIA GEMINA (A. Schmidt) Mann

(Schmidt, Atlas, pl. 80, fig. 16.)

The original specimen was from the Samoan Islands.

BIDDULPHIA GIBBOSA (Bailey) Van Heurck

(Wilkes Exp., p. 181, pl. 9, fig. 32; Schmidt, Atlas, pl. 80, figs. 13–21.)

This diatom's place among the *Biddulphiae* is most questionable. Bailey himself indicated doubt of the correctness of the assignment. The peculiar finishing of its angles, which have, instead of horns or processes, flat disciform areas, bounded on the outer side by semicircular ridges, like the eyebrows over an eye, and each accompanied by a single, sharp, curved spine, gives it a strikingly individual aspect. Its delicate texture and beading are also unique. The side view is even more unlike *Biddulphia* than that of the face. Van Heurck, De Toni, and others suggest its classification under Bailey's genus *Lampriscus,* in company with such forms as *Triceratium circulare* Shadbolt, *T. shadboltianum* Greville, *T. globosum* Bailey, etc. To this group should probably be added that doubtful example of *Aulacodiscus, A. kittonii* Arnott. De Toni does not assign to *Lampriscus* the single figure of that diatom given in Schmidt's Atlas (pl. 80, fig. 11), but for some undivulged reason puts all the others under *Aulacodiscus kittonii.* Although favorable to a change of genus I here follow the *Biddulphia* classification, pending further discussion of the subject.

BIDDULPHIA GRUNDLERI A. Schmidt

(Schmidt, Atlas, pl. 118, figs. 22–24.)

BIDDULPHIA GRUNOWIANA (Castracane) Mann

(Castracane, Chall. Exp., p. 110, pl. 16, fig. 5.)

BIDDULPHIA HETEROCEROS Grunow

(Van Heurck, Synopsis, pl. 102, fig. 5.)

BIDDULPHIA IMPRESSA (Grunow) Mann

(Van Heurck, Synopsis, pl. 115, figs. 3–6.)

De Toni (Syl. Alg., p. 986) places this in *Lithodesmium,* but expresses doubt of its correctness.

BIDDULPHIA INDICA (Ehrenberg) Roper

(Micro. Journ., 1859, pl. 1, figs. 20–22.)

BIDDULPHIA INFORMIS, new species

Plate 9, figs. 2, 3

Valve convex, elongated, naviculoid, broadened at the middle and with wedge-shaped ends, covered with scattered beads irregularly distributed, the two horns at the extreme apices; in side (girdle) view the horns are seen to rise perpendicularly from the apices, the outer and straight side being the extremity of the valve, the inner side sloping backward to the valve surface; girdle relatively broad and hyaline, except for a single row of minute beads along each edge.

Length of valve, 0.066–0.087; width of valve, 0.016–0.018 mm.; depth of frustule, 0.033 mm.

This singularly crude diatom was found in two dredgings but was infrequent in both. Its girdle view reminds one of the doubtful *Plagiogramma van huerckii* Grunow (Van Heurck, Synopsis, pl. 36, fig. 4).

Type.—Cat. No. 43594, U.S.N.M.

BIDDULPHIA INSIGNIS (Greville) Mann

(Micro. Journ., 1861, p. 75, pl. 9, fig. 5; Schmidt, Atlas, pl. 78, fig. 3.)

BIDDULPHIA INVERTA, new species

Plate 9, fig. 4; plate 10, figs. 2, 3

Valve triangular, its sides straight or barely concave; center a domelike convexity separated from the broad bases of the three horns by three deep sinuses that appear in face view as three narrow hyaline bands uniting to form an inner triangle in reversed position to that of the valve; the whole surface of the valve, except the tips of the horns and the three hyaline sinuses, loosely covered with large, crudely formed beads showing an imperfectly radial arrangement; in side view the apparently simple topography of the valve surface is seen to be a highly complicated series of elevations and depressions; the bases of the massive horns are separated from the domelike center by deep sinuses, their tips rounded, incurved, and covered with fine, closely, and regularly set beads; a deep groove runs around the base of the valve (next to the girdle); on each half of the girdle, which is very wide, a single row of large beads along the line of its attachment to the valve, below this a few large scattered beads and toward the bottom of each half similar beads closely set in vertical rows, that is, transverse to the girdle, six to eight beads long.

Diameter of valve (apex to middle of opposite side), 0.169–0.287 mm.; height of frustule, 0.265–0.282 mm.

The form or architectural plan is carried in this and similar species of *Biddulphia* to so high a degree of complexity that an accurate image of the specimen by means of description without the aid of illustration is quite impossible. The highly elaborate ornamentation of this diatom showed slight variations in the large number of specimens obtained.

It is related more or less closely to *Triceratium partitum* Greville (Moebius, Diat. Taf., pl. 55, fig. 8; Micro. Journ., 1864, pl. 2, fig. 8) to *T. cellulosum* Greville as figured by Walker and Chase (New Diat., pl. 4, fig. 8), but less so with the original in the Microscopical Journal for 1861, plate 4, figure 14, with *T. expressum* Janisch (Schmidt, Atlas, pl. 94, fig. 16) and, except for the very unlike horns, with *T. madagascarense* Grunow (Schmidt, Atlas, pl. 94, fig. 15).

Type.—Cat. No. 43595, U.S.N.M.

BIDDULPHIA JUNCATENSIS (Grunow) Mann

(Schmidt, Atlas, pl. 76, fig. 13.)

This species is incorrectly united with *B.* (*T.*) *inelegans* (Greville) by Boyer (Bidd. Forms, p. 725). It is found both in Campeche Bay and the Philippine Islands, but not elsewhere.

BIDDULPHIA JUNCTA (A. Schmidt) Mann

(Schmidt, Atlas, pl. 98, figs. 1–3.)

This large and handsome diatom is quite common in the Philippine Islands. Its being a *Biddulphia* is so evident that one wonders why Schmidt did not in this instance break away from the untenable arrangement of putting such forms in *Triceratium.*

BIDDULPHIA MADAGASCARENSIS (Grunow) Mann

(Schmidt, Atlas, pl. 81, fig 18; pl. 94, fig. 15; Van Heurck, Synopsis, pl. 108, fig. 8.)

This species has rather too close resemblance to *T. radio-punctatum* A. Schmidt (Schmidt, Atlas, pl. 94, fig. 14).

BIDDULPHIA MEMBRANACEA Cleve

See *Trigonium membranaceum* (Cleve) Mann.

BIDDULPHIA MOBILIENSIS Bailey

(Amer. Journ. Sci., 1845, p. 336, pl. 4, fig. 24; Van Heurck, Synopsis, pl. 101, figs. 4–6.)

The best figures for distinguishing between this and the similar *B. chinensis* Greville are to be found in Schmidt's Atlas on plate 122. Although common in Japanese waters it is rather uncommon in the Philippine Islands.

BIDDULPHIA PAPILLATA (Grove and Sturt) Mann

(Grove and Sturt, Oamaru Diat., p. 14, pl. 6, fig. 14.)

BIDDULPHIA PENTACRINUS (Ehrenberg) Boyer

(Schmidt, Atlas, pl. 98, figs. 7–13.)

BIDDULPHIA PETITIANA (Leuduger-Fortmorel)? Mann

Plate 10, figs. 4, 5

I figure this unique and rare diatom because, although I can not separate it from *Triceratium petitianum* as figured and described by Leuduger-Fortmorel (Diat. Cot. Occ. Africa, p. 28, pl. 5, fig. 12) and probably including the unnamed figure in Schmidt's Atlas on plate 94, figure 10, it differs very greatly from it in its markings. The original is covered with coarse, irregularly placed beads or blotches, with no reticulations. There can be no question of error in this, because the diatom is carefully described and twice illustrated and several specimens were found, as is indicated by the measurements given. In contrast to this, the valves of all my specimens are covered with a coarse strong reticulation, except on the ends of the two processes, and within the reticulum are accurately arranged rows of fine perfect beading, radiating from the center of the valve and also covering the unreticulated ends of the two processes. In the center is a single blunt curved spine. The girdle is covered with closely set regular rows of beads running vertically, that is, across the girdle, the beads being of the same size as those on the valve.

Length of valve, 0.056–0.059; width, 0.037–0.039; height of frustule, 0.065–0.079 mm. Length of valve of Leuduger-Fortmorel specimens, "4–7 *c.d.m.*"

Type.—Cat. No. 43596, U.S.N.M.

BIDDULPHIA PETITII (Leuduger-Fortmorel) Mann

Plate 8, fig. 4

(Leuduger-Fortmorel, Diat. Malaisie, p. 39, pl. 6, fig. 3.)

Cerataulus turgidus Ehrenberg has been made the repository for several allied forms having in common massive, oval and convex valves, with two heavy blunt horns capped with round or oval hyaline ends, analogous to the ocelli of certain species of *Auliscus*, and generally set one near to each end of the long axis of the valve but a little to one side of it. To a few forms distinctive names have been given, but several species still appear under the old Ehrenberg name. The best collections of figures of diatoms of this group are to be found in Schmidt's Atlas, plates 115 and 116, and in A. Forti's Contributions to Diatoms, 1910, plates 1 and 2.

The old genus *Cerataulus* can not be marked off from *Biddulphia* by satisfactory characters. Both are normally of elongated or oval valve outline, very convex and deep, and united by a wide girdle, so that the frustule is usually deeper than wide; at the apices of the bilateral valves are two massive processes or horns; the markings are frequently coarse and more or less radial, and spines, sometimes in large number, are often superposed on the sculpture; these in some species like *Biddulphia heteroceros* Grunow and *Cerataulus turgidus* Ehrenberg, are massive, long and bifurcated at the tip; the method of growth of the two is the same; so that on the whole it is no wonder the same diatom is assigned by one able diatomist to *Biddulphia* and another equally able to *Cerataulus*, as in the case of *Biddulphia radiata* Roper and *Cerataulus smithii* Ralfs.

The Philippine specimens of the present species, *B. petitii*, vary somewhat from the type form of Leuduger-Fortmorel, judged by his sketchy figure and rather meager description; the horns being not to one side of the long axis but bisected by it, the spines near the middle being not fewer and smaller but closer and larger, and the beading being not rectangular but radial. But comparison of the two figures will show that these differences are not specifically important. The type came from the near-by island of Java.

BIDDULPHIA PULCHELLA Gray

(Smith, Brit. Diat., pl. 44, fig. 321; Schmidt, Atlas, pl. 118, figs. 26–33.)

This cosmopolitan species is known to be very variable both in size and form. Small specimens, with deep valves and girdles, so wide as to give a tubular form, are the prevailing ones in the Philippine Islands.

BIDDULPHIA PUNCTATA Greville

(Micro. Journ., 1864, pl. 11, fig. 10.)

The type came from the fossil bed at Cambridge, Barbados. Boyer's *B. interrupta* (Proc, Acad. Nat. Sci. Phila., 1898, pl. 24, fig. 2.) is simlar, but has radiating beads, spines at the center, and the interrupting arcuate bands do not fully cross the valve.

BIDDULPHIA PYGMAEA, new name

(Schmidt, Atlas, pl. 98, fig. 16.)

This species is accurately illustrated in the above figure, and there named *Triceratium pulchellum* Grunow. It is an evident *Biddulphia*, but can not be transferred with its specific name because of *B. pulchella* Gray. It is therefore renamed. It is also what is called *T cornutum*, var. *pulchella* Grunow, in Van Heurck's Synopsis, plate 108, figures 12–13, but this can hardly be united with Greville's *T. cornutum* in the Microscopic Journal for 1861, page 45, plate 8, figure 8.

BIDDULPHIA RETICULATA Roper

(Micro. Journ., vol. 7, pl. 2, figs 14–17; Schmidt, Atlas, pl. 78, figs 21–23; pl. 84, figs, 9, 15, 16; pl. 85, fig. 8.)

The variety, *subspinosa*, figured in Schmidt's Atlas, plate 84, figure 15, also found, is questionable as belonging here.

BIDDULPHIA RETIFORMIS, new species

Plate 10, fig. 6

Valve fusiform, the broad spindle made up of a very convex circular central part, from opposite sides of which protrude two triangular extensions, their surfaces at a lower level than the central part and ending in sharp angles from which arise two horns pointing obliquely outward; the circular central part is covered with a reticulate network of lines, set with numerous fine prickles and underlaid with radiating rows of beading; the network is replaced on the two extensions by three to four longitudinal ridges; the horns are long, narrow, tapering, and enlarged at the ends.

Length 0.056; width 0.031 mm.

Although only a single specimen was found, I can not reconcile its symmetrical form and its reticulate markings with the idea that it is an abnormal two-angled specimen of *B. pentacrinus* (Wallich) Van Heurck.

Type.—Cat. No. 43597, U.S.N.M.

BIDDULPHIA ROBERTSIANA (Greville) Boyer

(Micro. Journ., 1863, p. 231, pl. 9, fig 9; Schmidt, Atlas, pl. 83, figs. 3, 5–7.)

Both the type form and the spineless variety called *inermis* were found.

BIDDULPHIA ROPERIANA Greville

(Micro. Journ., vol. 7, pl. 8, figs. 11–13; H. L. Smith, Types, No. 625; Van Heurck, Synopsis, pl. 99, figs. 4–6.)

BIDDULPHIA RUDIS, new species

Plate 10, fig. 7

Valve triangular, massive and practically hyaline, a few scattered imperfect blotches being dimly seen on some specimens; apices very blunt, with three short stout horns of the *Cerataulus* pattern, ending in circular disks that are inclined outward.

As no complete frustule was found, the girdle aspect is unknown.

Diameter (measured from one apex to opposite side) 0.059 mm.

There is a slight resemblance between this and the unnamed figure in Ostrup, Diatoms of Siam, plate 1, figure 4.

Type—Cat. No. 43598, U.S.N.M.

BIDDULPHIA SCHMIDTII (Janisch) Mann

(Schmidt, Atlas, pl. 86, figs. 1–2; pl. 85, figs. 3–4, variety.)

BIDDULPHIA SCITULA (A. Schmidt) Mann, new name

(Schmidt, Atlas, pl. 84, figs. 5–6, misnamed.)

It is evident that Brightwell's species bearing the name of *Triceratium scitulum* is a somewhat delicate variety of *B. favus* (Ehrenberg) Van Heurck; but Schmidt groups with this two figures which are not like Brightwell's variety of *favus* nor like its type form; and in uniting the true figures of Brightwell's with *B. favus* he leaves out these two figures. They correspond to the present species. They, therefore, require a separate specific name and I here propose *B. scitula* (A. Schmidt) Mann, new name.

This is another species common to both Campeche Bay and the Philippine Islands.

BIDDULPHIA SECEDENS (A. Schmidt) Mann

(Schmidt, Atlas, pl. 126, figs. 3–4.)

BIDDULPHIA SETIGERA (Bailey) Mann

(Smiths. Contrib., 1854, p. 11, pl. 1, fig. 26.)

For a discussion of the adoption of this name given in 1854, rather than either of its synonyms, *Triceratium spinosum* Bailey (1843) or *T. armatum* Roper (1854) see my Diatoms of the Albatross Voyages, p. 309.

BIDDULPHIA SPINULOSA (Grunow) Mann

(Schmidt, Atlas, pl. 87, fig. 1.)

BIDDULPHIA STOKESIANA (Greville) Mann

(Micro. Journ., 1866, p. 8, pl. 2, fig. 23; Schmidt, Atlas, pl. 112, fig. 19.)

BIDDULPHIA TABELLARIA (Brightwell) Boyer

(Micro. Journ., vol. 4, p. 275, pl. 17, fig. 15; Schmidt, Atlas, pl. 77, figs. 1–5.)

Here are included *Triceratium venulosum* Greville and, with considerable doubt, var. *diplosticta* Grunow and *T. grave* A. Schmidt (See Schmidt, Atlas, pl. 77, fig. 17, and Truan and Witt, Diat. Hayti, pl. 7, figs. 1, 13.)

BIDDULPHIA TEMPEREI (Brun) Mann

(Le Diat., vol. 1, p. 33, pl. 3, fig. 7.)

BIDDULPHIA TRIPOS (Cleve) Mann

(Cleve, New and Little Known Diat., p. 24, pl. 6, fig. 68; Schmidt, Atlas, pl. 84, fig. 8.)

A remarkable specimen, circular in form and with two processes was found, as well as the typical triangular form.

BIDDULPHIA TRISINUA, new species

Plate 10, figs. 8–9

Valve triangular, trifoliate, the sides deeply concave, the angles broad and blunt; the three processes or horns rounded, closely beaded; across each angle back of the processes is a transverse row of irregularly placed beads; the central part of the valve sparingly dotted with minute beads arranged in imperfect circles; in side (girdle) view the valve is seen to be flat in the center, the horns vertical and enlarged at the ends; the sides of the valve sparingly and irregularly dotted, like the upper surface; a small groove extends around the valve next to the rim, which is not produced beyond the rest of the valve.

Diameter of valve (measured from apex to opposite side), 0.101 mm.; height of valve, 0.090 mm.

This can hardly be made a variety of *Triceratium trisulcum* Bailey, its nearest relative (Schmidt, Atlas, pl. 78, figs. 5–8; pl. 94, fig. 5; pl. 112, figs. 11–18). Also compare with *T. turriferum* Truan and Witt (Diat. Hayti, pl. 7, figs. 22–23.)

Type.—Cat. No. 43599, U.S.N.M.

BIDDULPHIA TUMESCENS (Castracane) Mann

(Castracane, Chall. Exp., p. 109, pl. 6, fig. 9.)

Among the specimens found one resembles *T. robertsianum*, forma *inermis* (Schmidt, Atlas, pl. 83, fig. 4), but Castracane's species is valid because the processes are blunt disks, not horns, and the areolation reaches to their bases. De Toni somehow manages to discover a likeness between this and *T. fimbriatum* Wallich.

BIDDULPHIA TUOMEYI (Bailey) Roper

(Micro. Journ., 1859, p. 8, pl. 1, figs. 1–2; Schmidt, Atlas, pl. 119, figs. 1–8.)

Numerous specimens of this widely distributed and essentially fossil diatom were found and, so far as could be made out, were members of the now living flora.

BIDDULPHIA TURGIDA W. Smith

(Smith, Brit. Diat., p. 50, pl. 62, fig. 384; Van Heurck, Synopsis, pl. 104, figs. 1–2.)

Together with the typical form a somewhat spiny-covered variety was found.

BIDDULPHIA TURRIGERA, new species

Plate 11, figs. 1, 2

Valve triangular, with barely convex sides; horns in the angles tall, erect, with truncated apices, their flat triangular ends having each a central rosette of watery beads; surface of the valve hyaline, flat to near the margin, then sloping diagonally downward; in side (girdle) view the three flat-topped horns are seen to be notched near the top on the outside; sides of the valve hyaline like its upper surface; girdle densely covered with rows of beading running vertically, that is, across it.

Diameter of valve (measured from apex to opposite side), 0.045–0.082 mm.; height of frustule, 0.056–0.073 mm.

This species, which is of the *Triceratium castelliferum* group resembles most nearly one of the figures of *T. turriferum* Truan and Witt, as given in their Diatomaceen von Hayti, plate 7, figure 6.

Type.—Cat. No. 43600, U.S.N.M.

BIDDULPHIA UNDULOSA, new species

Plate 11, fig. 3

Valve broadly oval, convex, its margin strongly undulating, or more correctly, scalloped, the indentations being broadly curved, but the external points of union between the scallops being acute angles; a short pedicelled horn set close to the margin at either end of the valve; surface of valve dusted over with an exceedingly fine rugosity and evenly covered with thickly set sharp but very short prickles; the girdle, joining the two strongly convex valves, is ribbed to correspond with the undulations of the rim of the valves, and is more coarsely rugose than it, but destitute of prickles.

Length, 0.089; width, 0.076 mm.

Comparison may be made with *B. punctata* Greville from Oamaru, New Zealand (Schmidt, Atlas, pl. 141, figs. 2–3).

Type.—Cat. No. 43601, U.S.N.M.

Genus CAMPYLODISCUS Ehrenberg

CAMPYLODISCUS ADORNATUS A. Schmidt

(Schmidt, Atlas, pl. 51, fig. 5; pl. 52, fig. 3; Deby, Campy., pl. 3, fig. 21.)

This is rather too close to *C. ornatus* Greville to justify a separate name. It is another of the forms found in both Campeche Bay and the Philippine Islands.

CAMPYLODISCUS ADRIATICUS Grunow

(Schmidt, Atlas, pl. 16, figs. 13–16, 18; Deby, Campy., pl. 5, fig. 34.)

CAMPYLODISCUS AMBIGUUS Greville

(Micro. Journ. vol. 8, p. 31, pl. 1, fig. 5; Schmidt, Atlas, pl. 18, figs. 21–26; pl. 51, fig. 14.)

It is an open question if it is best to follow De Toni's plan of uniting this with *C. latus* Shadbolt. Compare the original figures and descriptions of the two in the Microscopic Journal for 1854, page 16, plate 1, figure 13, and that Journal for 1860, page 31, plate 1, figure 5.

CAMPYLODISCUS ANCEPS Castracane

(Castracane, Chall. Exp., pl. 16, fig. 20; Deby, Campy., pl. 5, fig. 1; see also Janisch, Gaz. Exp., pl. 19, fig. 8.)

See discussion of this form under *Surirella schleinitzii* Janisch.

CAMPYLODISCUS BELLUS A. Schmidt

(Schmidt, Atlas, pl. 207, fig. 4.)

CAMPYLODISCUS BIANGULATUS Greville

(Micro. Journ., vol. 10, pl. 4, fig. 1; Schmidt, Atlas, pl. 14, figs. 18–22; Deby, Campy., pl. 2, fig. 12.)

Here are included *C. lorenzianus* Grunow and *C. zebuanus* Castracane. Greville's type specimen came from Manila, Philippine Islands.

CAMPYLODISCUS BILATERALIS, new species

Plate 11, fig. 4

Valve slightly longer than wide, having along either side a strong band about one-tenth the cross diameter of the valve in width, until near the ends or poles of the valve it rapidly narrows to a mere line running around the ends; this band is transversely marked with wide evenly spaced lines, each of which terminates in a bead at the margin; the rest of the valve surface is covered with closely spaced lines that extend inward to the narrow hyaline median line connecting the two valve ends, these inner and finer lines being progressively radial and curved as they approach the ends, and showing a tendency to bifurcate where they join the bands on each side.

Diameter (between ends), 0.107 mm.

Type.—Cat. No. 43602, U.S.N.M.

CAMPYLODISCUS BRIGHTWELLII Grunow

(Wien. Verh. Zoo-Bot. Gesell., 1862, pl. 9, fig. 5; Schmidt, Atlas, pl. 15 figs. 6–7.)

This can not be distinguished from *C. grevillei* Leuduger-Fortmorel (Diat. Ceyl., pl. 5, figs. 54–56, 1879) or from *C. kinkerii* A. Schmidt (Atlas, pl. 207, fig. 16.)

CAMPYLODISCUS BROWNEANUS Greville

(Micro. Journ., 1862, p. 89, pl. 9, fig. 2; Deby, Campy., pl. 5, fig. 24A.)

CAMPYLODISCUS CASTRACANEI Janisch

(Janisch, Gaz. Exp., pl. 19, fig. 15.)

Deby claims the true figure of this species to be the one in the Report of the Gazelle Expedition, plate 20, figure 1, while the above he unites with *C. incertus* A. Schmidt (Schmidt, Atlas, pl. 15, figs. 13–15). I consider this to be a weak distinction, a specific demarcation between the two figures of Janisch being impossible. Furthermore he makes *C. incertus* A. Schmidt a synonym under *C. samoensis* Grunow (Schmidt, Atlas, pl. 15, figs. 18—20) although Schmidt's name precedes the latter. De Toni (Syl. Alg., p. 609) follows these opinions.

CAMPYLODISCUS COCCONEIFORMIS Grunow

(Cleve, Vega, p. 502, pl. 38, fig. 78; Deby, Campy., pl. 9, fig. 51.)

Although this diatom is here placed under *Campylodiscus* for convenience, there is much doubt of its belonging here. De Toni also follows the generic name with a question mark. I have found this puzzling form also at Georgetown, British Guiana.

CAMPYLODISCUS COMPTUS Janisch

(Janisch, Gaz. Exp., pl. 19, fig. 16.)

C. macassarensis (Grove) Deby (Deby, Campy., pl. 14, fig. 71) is rather close to this, as is also *C. crebrecostatus* Greville; see below.

CAMPYLODISCUS CONCINNUS Greville

(Schmidt, Atlas, pl. 53, fig. 9; also Schmidt, Atlas, pl. 18, fig. 18.)

My specimen corresponds exactly with the var. *lineata* Grunow of the above reference. I do not agree with Deby in making this and the type form (Micro. Journ., 1860, p. 30, pl. 1, fig. 2) synonymous with *C. imperialis* Grunow (compare H. L. Smith, Types, No. 626.)

CAMPYLODISCUS CONTIGUUS A. Schmidt

(Schmidt, Atlas, pl. 18, figs. 19–20.)

Judging by the figures Schmidt's form is sufficiently unlike *C. latus* Shadbolt to warrant its apologetic name. If the actual diatoms have been seen to be alike by Deby he is justified in uniting them.

CAMPYLODISCUS CREBRECOSTATUS Greville

(Micro. Journ., 1864, pl. 1, fig. 6; Schmidt, Atlas, pl. 14, fig. 28.)

Janisch's *C. comptus* (see above) runs close to this, as does also *C. intermedius* Grunow.

CAMPYLODISCUS DECORUS Brébisson

(Brébisson, Diat., Cherb., p. 14, pl. 1, fig. 2; Van Heurck, Synopsis, pl. 72, fig. 3; Deby, Campy., pl. 2, fig. 15.)

De Toni (Syl. Alg., p. 612) groups this with *C. ralfsii* W. Smith and says, "*C. decorus* vix a *C. ralfsii* differt nisi pseudorhaphe distincta." This is not quite true; but even so, it is a more satisfactory mark of distinction than many species can boast.

CAMPYLODISCUS DAEMELIANUS Grunow

(Schmidt, Atlas, pl. 17, fig. 11; pl. 54, figs. 1–2; Deby, Campy., pl. 12, fig. 53.)

Among the large number of specimens found considerable difference exists, not in the plan of ornamentation but in the degree to which it is carried out.

CAMPYLODISCUS DENTATUS Deby

(Deby, Campy., pl. 14, fig. 74.)

The only specimens recorded come from the Philippine Islands.

CAMPYLODISCUS DIPLOSTICTUS Norman

(Micro. Journ., 1860, pl. 1, fig. 6; Schmidt, Atlas, pl. 207, fig. 2.)

The type came from Australia. It is practically the same as *C. robertsianus* Greville, which see.

CAMPYLODISCUS EMARGINATUS Deby

(Deby, Campy., p. 65, pl. 14, fig. 73.)

This is reported living in the Sea of Japan (Rae) and fossil in Japan (Macrae).

CAMPYLODISCUS EXIMIUS Gregory

See under *C. hodgsonii* W. Smith.

CAMPYLODISCUS GREVILLEI Leuduger-Fortmorel

(Leuduger-Fortmorel, Diat., Ceyl., p. 47, pl. 5, figs. 54–56.)

As mentioned under *C. brightwellii* Grunow, it and this form can not be clearly distinguished from each other. De Toni admits their practical unity, but puts Grunow's name as a synonym under the above, the date of which is 1879. Grunow published his figure and description in 1862. Schmidt's *C. kinkerii* (Schmidt, Atlas, pl. 207, fig. 16) is scarcely admissible to the dignity of a variety of this.

CAMPYLODISCUS HIBERNICUS Ehrenberg

(Ehrenberg, Mikrogeologie, pl. 15A, fig. 9; Schmidt, Atlas, pl. 55, figs. 9–16; Deby, Campy., pl. 11, fig. 58.)

Although I here record this among the marine diatoms of the Philippine Islands, it is a strictly fresh-water species. It was doubtless brought down as river detritus. Between this and *C. noricus* Ehrenberg, also a fresh-water species, so many intermediate forms occur that a satisfactory boundary line between them is impossible.

CAMPYLODISCUS HODGSONII W. Smith

(Smith, Brit. Diat., pl. 6, fig. 53; Schmidt, Atlas, pl. 53, fig. 5; Deby, Campy., pl. 1, fig. 7.)

Cleve in Schmidt's Atlas (pl. 207, fig. 19) claims that the original specimens of this and *C. eximius* Gregory, figured by Gregory (Diat. Clyde, pl. 11, fig. 54) are the same species. To this I agree. Note their identical geographic distribution recorded in De Toni (Syl. Alg., pp. 610 and 628). Both De Toni and Deby (Deby, Campy., p. 43) accord to them separate rank.

CAMPYLODISCUS HOROLOGIUM Williamson

(Ann. Mag. Nat. Hist., 1848, ser. 2, vol. 1, p. 321; Smith, Brit. Diat., pl. 6, fig. 51; Schmidt, Atlas, pl. 51, fig. 7; Deby, Campy., pl. 6, fig. 29*a*.)

Here is included a hardly separable variety called *C. pfitzeri* A. Schmidt in his Atlas, plate 17, figures 5–6. This same form was found by the *Challenger* expedition at the Philippine Islands and named by Castracane *C. lepidus* (Chall. Exp., pl. 16, fig. 7), although his type specimen was from the Sea of Japan and to this he gave the name of *C. orbicularis* (Chall. Exp., pl. 16, fig. 10).

CAMPYLODISCUS INCERTUS A. Schmidt

(Schmidt, Atlas, pl. 15, figs. 13–15.)

As mentioned under *C. castracanei,* this name in Schmidt's Atlas precedes *C. samoensis* Grunow on the same plate (figs. 18–20), despite which Deby and De Toni adopt the latter. The doubt implied in the specific name may refer to this likeness between the two, although Schmidt may have had in mind *C. concinnus* Greville, between which and these forms a marked resemblance exists. As already mentioned, I see no gain for purposes of identification in placing *C. concinnus* under *C. imperialis.*

CAMPYLODISCUS INOPINUS A. Schmidt

(Schmidt, Atlas, pl. 207, fig. 18.)

CAMPYLODISCUS INTERMEDIUS Grunow

(Schmidt, Atlas, pl. 14, fig. 30; pl. 18, fig. 9.)

The resemblance to *C. crebrecostatus* Greville is close enough to deserve mention, but not close enough to unite them, as is done by De Toni (Syl. Alg., p. 613).

CAMPYLODISCUS KINKERII A. Schmidt

See under *C. brightwellii* Grunow.

CAMPYLODISCUS KITTONIANUS Greville

(Micro. Journ., 1850, p. 32, pl. 1, fig. 7; Schmidt, Atlas, pl. 16, figs. 19–20 Deby, Campy., pl. 10, fig. 52.)

CAMPYLODISCUS LATUS Shadbolt

(Micro. Journ., 1854, p. 16, pl. 1, fig. 13; Schmidt, Atlas, pl. 207, figs. 6–9; Deby, Campy., pl. 3, fig. 30*b*.)

It has a wide geographical distribution, and is also quite variable. *C. ambiguus* Greville (Micro. Journ., 1860, pl. 1, fig. 5) may be the same.

See remarks under *C. ambiguus* and *C. contiguus.*

CAMPYLODISCUS LIGULOSUS, new species

Plate 11, fig. 5

Valve circular, strongly bent, its border consisting of an outer narrow band of a single row of small polygonal divisions rounded on their inner side and forming an angle on their outer side, the apex of each angle ending in a minute bead or bar reaching to the rim of the valve; within this band is a single row of broad tonguelike and glassy scallops of slightly unequal length and very irregular width, being from two to five times as wide as the polygonal partitions of the outer band, the largest scallops being at the two ends of the valve; the central portion of the valve, two-thirds its diameter, is without markings, except for a short central, rugose line, running toward but not reaching the ends.

Both diameters, 0.047 mm.

Although there is considerable similarity between this and the figure of *C. dubius* Leuduger-Fortmorel (Diat., Ceylan, pl. 4, fig. 47) his description on page 46 clearly shows that the two are separate species.

Type.—Cat. No. 43603, U.S.N.M.

CAMPYLODISCUS LIMBATUS Brébisson

(Brébisson, Diat., Cherb., pl. 12, fig. 1; Schmidt, Atlas, pl. 17, figs. 2–5; Deby Campy., pl. 10, fig. 62.)

CAMPYLODISCUS MUELLERI A. Schmidt

(Schmidt, Atlas, pl. 14, fig. 13; Deby, Campy., pl. 6, fig. 27.)

This is another of the forms peculiar to both Campeche Bay and the Philippine Islands. De Toni (Syl. Alg., p. 621) rightly notes its suspicious resemblance to *C. browneanus* Greville.

CAMPYLODISCUS ORNATUS Greville

(Micro. Journ., 1863, pl. 1, fig. 3; Schmidt, Atlas, pl. 17, fig. 17; pl. 51, figs. 2, 3, 6; Deby, Campy., pl. 10, fig. 60.)

According to Deby, Castracane's *C. philippinarum* (Chall. Exp., pl. 11, fig. 9) is identical with this.

CAMPYLODISCUS PERSPICUUS, new species

Plate 11, fig. 6

Valve circular, strongly bent; border consisting of an outer narrow row of rectangular beading, within which is a second row of longer, smooth, tonguelike divisions, and within these a final row of narrow but strong coastal ridges running radially halfway to the center, about 36 in number, which is approximately one-third the number of divisions of the second row; in this latter row the divisions are equal in length, except those that are continuous with the coastal ridges of the inside row, which are about twice as long as the others; the subcircular central portion, about one-half the diameter of the valve, is obscurely covered with wrinkles, a median longitudinal one being the strongest; a prominent bead is set in the outside rectangular row at each end of the valve, marking the two polar areas.

Width, 0.099; length, 0.096 mm.

Type.—Cat. No. 43604, U.S.N.M.

CAMPYLODISCUS PFITZERI A. Schmidt

See *C. horologium* Williamson.

Although De Toni thinks this worthy of mention as a variety of *C. horologium*, I do not see any appreciable difference between the two. It is figured in Schmidt's Atlas, plate 17, figures 5–6.

CAMPYLODISCUS PHALANGIUM A. Schmidt

(Schmidt, Atlas, pl. 14, figs. 11–12; pl. 93, figs. 16–17; Deby, Campy., pl. 5, fig. 24c.)

I agree with Deby in recognizing this as separate from *C. browneanus* Greville, of which De Toni (Syl. Alg., p. 620) makes it a variety. It is another form peculiar to Campeche Bay and the Philippine Islands.

CAMPYLODISCUS PUNCTULATUS Grunow

(Schmidt, Atlas, pl. 17. fig. 4.)

This well-marked species is another example of the diatoms peculiar to both Campeche Bay and the Philiphine Islands.

CAMPYLODISCUS RABENHORSTIANUS Janisch

(Janisch and Rabenhorst, Diat., Hondur., p. 6, pl. 1, figs. 6–7; Schmidt, Atlas, pl. 53, figs. 12–14; Deby, Campy., pl. 9, fig. 46.)

Although not a strictly Campeche Bay form, it is approximately so, being abundant on the coast of Honduras.

CAMPYLODISCUS RALFSII W. Smith

(Smith, Brit. Diat., pl. 30, fig. 257; Schmidt, Atlas, pl. 14, figs. 1–3; Deby, Campy., pl. 2, fig. 18.)

As mentioned under *C. decorus* Brébisson, I do not favor uniting these two. But *C. scalaris* Tempère and Brun (Diat. Jap., pl. 4, fig. 12) seems to be only a variety of this form.

CAMPYLODISCUS RATTRAYANUS Deby

(Deby, Campy., p. 36; Schmidt, Atlas, pl. 18, fig. 10.)

The type, according to Deby and represented by the above figure of Schmidt, is from Brazil; but *C. schmidtii* Grunow, figured in Schmidt's Atlas (pl. 53, fig. 10), is possibly the same diatom and comes from Campeche Bay.

CAMPYLODISCUS RIVALIS A. Schmidt

(Schmidt, Atlas, pl. 8, figs. 1–2; Deby, Campy., pl. 2, fig. 17.)

CAMPYLODISCUS ROBERTSIANUS Greville

(Micro. Journ., 1863, pl. 1, fig. 5; Schmidt, Atlas, pl. 17, figs. 8–10; Deby, Campy., pl. 3, fig. 32.)

I give this name, the type specimen of which came from Queensland and specimens of which are recorded from the Philippine Islands by Deby; but there is doubt if it can be held distinct from *C. diplostictus* Norman. I found it to be quite frequent in several dredgings.

CAMPYLODISCUS SAMOENSIS Grunow

See under *C. incertus* A. Schmidt.

CAMPYLODISCUS TAENIATUS A. Schmidt

(Schmidt, Atlas, pl. 16, fig 2; pl. 51, fig. 1; Deby, Campy., pl. 7, fig. 41.)

I have found this also at Hilo Hilo, Hawaii.

CAMPYLODISCUS TRIUMPHANS A. Schmidt

(Schmidt, Atlas, pl. 15, figs. 4–5.)

This is another strictly Campeche Bay, Philippine Islands, species.

CAMPYLODISCUS WALLICHIANUS Greville

(Micro. Journ., 1863, pl. 1, fig. 14; Schmidt, Atlas, pl. 14, figs. 15–16; pl. 17, figs. 13–14.)

Genus CAMPYLONEIS Grunow

CAMPYLONEIS GREVILLEI (W. Smith) Grunow

(Van Heurck, Treat., p. 285, fig. 64; Van Heurck, Synopsis, pl. 28, figs. 8–16.)

Including the two varietal forms, *C. argus* and *C. regalis.*

Genus CESTODISCUS Greville

CESTODISCUS CINNAMOMEUS Grunow

See *Trigonium cinnamomeum* (Greville) Mann.

Genus CHAETOCEROS Ehrenberg (characters emended)

Although there can be no doubt that Shadbolt's *Bacteriastrum* must be recognized as a circular and otherwise slightly modified variation of this unique genus, so that a distinction of generic value can not be discovered for their separation, it is also doubtless true that *Bacteriastrum* is a very convenient subgeneric term. As in my Diatoms of the Albatross Voyages, I here follow the opinion of Van Heurck, De Toni, etc., but add "*Bacteriastrum*" in brackets to the circular forms here recorded, as an aid to identification.

CHAETOCEROS AFFINE Lauder

(Micro. Journ., 1864, pl. 8, fig. 5.)

CHAETOCEROS BOREALE Bailey

(Smith. Contrib., 1854, p. 8, figs. 22–23; Micro. Journ., 1860, pl. 2, fig. 18.)

CHAETOCEROS CELLULOSUM Lauder

See *C. lorenzianus* Grunow.

CHAETOCEROS COARCTATUS Lauder

(Micro. Journ., 1864, pl. 8, fig. 6; Cleve, Java Diat., pl. 2, fig. 10.)

CHAETOCEROS CURVISETUM Cleve

(Gran, Norsk. Exp., pl. 3, fig. 43.)

CHAETOCEROS DIADEMA (Ehrenberg) Gran.

(Gran. Protophyta, p. 20, pl. 2, figs. 16–18; Micro. Journ., 1856, pl. 7, figs. 49–52.)

Only the endocysts of this pelagic diatom were found, what Ehrenberg called *Syringidium diadema* (Mikrogeologie, 35A, pl. 18, fig. 13), and in the second reference above.

CHAETOCEROS FURCA Cleve

(Cleve, Phytoplank., pl. 1, fig. 10.)

CHAETOCEROS (BACTERIASTRUM) HEBES, new species

Plate 11, fig. 7

Valve circular, hyaline; central part slightly convex, below which is set the ring of radiating arms; the bases of these have strong insets in the valve, producing a fictitious inner ring; they are stout, tapered, straight, with blunt ends and are wound spirally with two thread-like ridges set with spines and so spaced that the upper and under ridges produce a criss-cross effect.

Diameter of valve, 0.017 to 0.025 mm.; with arms, 0.084 to 0.096 mm.

Lauder's name, *B. varians*, has doubtless prevented observers from detecting some actually distinct species of these circular forms of *Chaetoceros;* for, although his species does vary, several types, like the one here described, can not be looked upon as mere variations.

Type.—Cat. No. 43605, U.S.N.M.

CHAETOCEROS LORENZIANUM Grunow

(Grunow, Neu. Ungen. Diat., p. 157, pl. 14, fig. 13; Van Heurck, Synopsis, pl. 82, fig. 2; H. L. Smith, Types, No. 629.)

Grunow's name, given in 1863, was followed the next year by Lauder's *C. cellulosus* (Trans. Micro. Soc., 1864, p. 78, pl. 8, fig. 12). A figure in Van Heurck's Synopsis, plate 82bis, figure 9, is incorrectly spelled *C. lorenzii* Grunow.

CHAETOCEROS (BACTERIASTRUM) MEDUSA, new name

Plate 12, figs. 1, 2

(Castracane, Chall. Exp., pl. 28, fig. 6, misnamed.)

This above-misnamed diatom is not a variety of *B. wallichii* Ralfs. (See Pritchard, Inf., p. 863, pl. 6, fig. 27.) Nor can it possibly be the same as what Castracane also calls *C. wallichii* in the Report of the Challenger Expedition, plate 23, figure 3. Ralfs' form is the *Chaetoceros bacteriastrum* Wallich (Micro. Journ., 1860, pl. 2, figs. 16–17). The specimen in the Report of the Challenger Expedition (pl. 29, fig. 6) came from Hongkong. See same from Gulf of Siam (Schmidt, Atlas, pl. 328, fig. 12, misnamed.)

Diameter of disk, 0.031; diameter including arms to their right-angle bend, 0.107; length of rest of arms from bend to tip, 0.072; length of entire arm therefore, 0.21 mm.

CHAETOCEROS (BACTERIASTRUM) PRINCEPS, new name

Plate 12, fig. 3

This is the form figured in the Report of the Challenger Expedition, plate 29, figure 3, and incorrectly named *B. varians* Lauder, var. *princeps* Castracane. It is wholly different from Lauder's form which, contrary to what Castracane says, has its arms spirally wound with a prickly line, sometimes two. The large circular valve of this species; the deep socketing of the arms or rays; the large number of these, 25; and the very convex valve, hyaline except for a central bead or umbo, combine to make it sufficiently dissimilar from *B.varians* to warrant a new name. I question its being the terminal form described in the Report of the Challenger Expedition (pl. 14, fig. 2), which is probably *B. hyalinum* Lauder. (See Micro. Journ., 1864, pl. 3, fig. 7a.) But it should be added that, as no good figure or description of the terminal valve of *B. hyalinum* Lauder is known, I can not affirm that my own form will not prove to belong to that species. As pointed out elsewhere, the specific name "*varians*" has doubtless been responsible for referring almost every *Bacteriastrum*-shaped *Chaetoceros* to this convenient depository.

Diameter of disk, 0.047; diameter with arms, 0.189 mm.

CHAETOCEROS SCOLOPENDRA Cleve

(Gran, Norweg. N. Atl. Exp., pl. 4, fig. 53; Cleve, Plankt. Sweden, pl. 1, fig. 5.)

This sharply marked species is quite common at the Philippine Islands.

CHAETOCEROS SOCIALE Lauder

(Micro. Journ., 1864, p. 77, pl. 8, fig. 1; Gran, Nord. Plank., fig. 123.)

Doubtless this diatom is more abundant than is recorded. It is easily overlooked in water or Canada balsam mounts, but shows up well in high refractive media, like barium-mercuric iodide.

CHAETOCEROS (BACTERIASTRUM) VARIANS (Lauder) Van Heurck

(Van Heurck, Synopsis, pl. 80, figs. 3–5; H. L. Smith, Types ,No. 57.)

The specific name is well chosen, *B. furcatum* Shadbolt, *B. curvatum* Shadbolt, and other so-called species belonging here. Nevertheless the aptness of the name has unquestionably led diatomists to refer forms here which a closer inspection would prove to be distinct. The temptation to put any delicate, circular form with radiating setae in this species is like that which has made *Biddulphia polymorpha* the receptable for a good many unrelated species.

See under *C. medusa* above.

CHRYSANTHEMODISCUS, new genus

Front (valve) view circular; inverted saucer-shaped, that is, barely convex to within about one-tenth of the radial distance to the margin, then rapidly curving to the margin; a circular and sharply marked central area or umbilicus, about one-eighth of the diameter of the valve in width, covered with round or oval beads, the outer row closely set and forming a perfect circle, those within evenly but not radially arranged; the rest of the valve marked with crowded radial lines or costae, slightly wider at their inner (umbilical) end and barely tapering to the margin, obscurely cross-marked but not divided into beads, somewhat tortuous, with shorter secondary lines so interspaced between them that the whole valve is evenly covered with a fine radial marking, as in certain members of the genera *Coscinodiscus, Actinocyclus*, etc.; the two valves similar; rim narrow, hyaline.

This genus somewhat resembles *Coscinodiscus* and still more nearly *Hyalodiscus*, from which, however, the strong radial lines and the robust central area covered with large well-formed beads unmistakably separate it. The width and ornamentation of the girdle is unknown, as no complete frustules were found. It is also questionable whether or not the frustules grow attached in pairs or chains, as in *Hyalodiscus* and *Melosira;* but the finished character of the central area implies that such is not the case.

CHRYSANTHEMODISCUS FLORIATUS, new species

Plate 13, fig. 1

General characters as in the genus. Mounted specimens frequently split inward from the margin into numerous petallike divisions, because of the convexity of the valve close to the edge and the delicate thinness of the valve between the closely set radial lines or costae.

Diameter of valve, 0.152 to 0.203; diameter of umbilicus, 0.025 to 0.028 mm. Not uncommon in two of the Philippine Islands dredgings, one being from the Sulu Island group.

Type.—Cat. No. 43606, U.S.N.M.

Genus CISTULA Cleve

(Cleve, Nav. Diat., vol. 1, p. 124.)

CISTULA LORENZIANA (Grunow) Cleve

(Wien. Verh., 1860, p. 547, pl. 1, fig. 3; Cleve, Nav. Diat., vol. 1, p. 124, pl. 1, fig. 31.)

Although Cleve's suggestion to create a new genus for this unique diatom does not seem to meet with general favor, I think it is justified. Its bisymmetrical valve with a rhaphe give it indeed a *Navicula*-like appearance; but its rectangular form, its peculiar undulating sculpture and the ends of the rhaphe set back from the extremities of the valve mark it out from *Navicula* more sharply than do those of such generally recognized genera as *Tropidoneis*, *Scoliopleura*, etc. While standing with Van Heurck in seeing the subgeneric but not the generic worth of most of the proposed new genera into which Cleve has divided the huge genus, *Navicula*, I think this and *Cymatoneis* at least are capable of such sharply cut distinction as deserve acceptance. This is another species found at both Campeche Bay and the Philippine Islands.

Genus CLAVICULA Pantocsek

CLAVICULA POLYMORPHA Grunow

(Pantocsek, Hung. Diat., p. 37, pl. 2, fig. 12; pl. 9, fig. 75; pl. 26, fig. 234, etc.)

Genus CLIMACOSPHENIA Ehrenberg

CLIMACOSPHENIA ELONGATA Bailey

(Schmidt, Atlas, pl. 308, figs. 5–10.)

Whether or not this is a variety of *C. moniligera* Ehrenberg is an open question.

CLIMACOSPHENIA MONILIGERA Ehrenberg

(Ehrenberg, Amer., vol. 2, pl. 6, fig. 1; Schmidt, Atlas, pl. 307, figs. 1–9; H. L. Smith. Types No. 631.)

The scarcity of early diatom literature explains Shadbolt's giving this the name *C. catena* (Micro. Journ., 1854, pl. 1, fig. 15). It occurs also in Campeche Bay; but having a rather wide distribution, the fact, taken by itself, has not much significance.

CLIMACOSPHENIA SCIMITER, new species

Plate 12, fig. 4

Valve typically club-shaped, but increasing in width evenly from base to apex; strongly curved sideways; its surface faintly marked by transverse moniliform lines, evident at the margin but indistinct toward the middle of the valve; the internal transverse septa delicate, very narrow, and showing at the middle either obscurely or not at all the break or sutural division common to specimens of this genus; about

20 of these septa, thus dividing the valve into 20 or more rectilinear compartments.

Length, 0.414; width, 0.028 mm.

A minute and fragile species that possibly is a sickle-shaped variety of *C. elongata* Bailey (New Species and Localities, p. 8, pl. 1 figs. 10–11), especially as Bailey notes the dimness of the crosslines at the center of the valve, mentioned above. But Bailey's form is more like *C. moniligera* Ehrenberg than like this Philippine form, not only in being straight, but in the cross septa ("vittae") and the more sudden increase in the width of the valve above the long narrow basal part. The fact is, it may be found eventually that both these are merely varietal modifications of *C. moniligera.* Indeed the unique characters of the genus hint at its being monotypic.

Type.—Cat. No. 43607, U.S.N.M.

Genus COCCONEIS (Ehrenberg) Grunow

COCCONEIS APICULATA A. Schmidt

(Schmidt, Atlas, pl. 198, fig. 31, and pl. 198, fig. 38, no name.)

I find the figure above with no name to be the same as Schmidt's Atlas, plate 198, figure 31. It may also be synonymous with "*Rhaphoneis mammalis* Cast.," Report of the Challenger Expedition, plate 26, figure 3, but this is uncertain. Were the two the same Castracane's name would stand, being given in 1886 and Schmidt's in 1895.

See a discussion of these forms under *C. citronella*, new species.

COCCONEIS CIRCULIFERA, new species

Plate 13, fig. 2

Valve oval, with sharp but not produced apices; markings of closely set lines indistinctly beaded, slightly undulating in unison, so that false longitudinal shadow lines parallel with the margin appear by change of optical focus; a narrow spindle-shaped hyaline area hardly reaching to the apices; on one side, adjacent to this hyaline area, not to the margin of the valve, is a small ring joined to a lunate half ring on its inner side, easily mistaken for two rings, one showing through from under the valve and slightly out of center with the upper first ring, whereas this ring and adjacent semiring are reproduced on each valve. Margin of valve heavy and hyaline.

Length, 0.056; width, 0.036; lines at margin, 11 in 0.01 mm.

Although there is a similarity between this and *Achnanthes heteromorpha* Grunow, as figured in Schmidt's Atlas, plate 198, figures 52–58, the difference in the markings, especially the position of the ocellus and its peculiar double form in this species, would preclude their being united, even if the side (girdle) view did not reveal the absence of any bend across the middle of the frustule, such as belongs to members of the genus *Achnanthes*.

Type.—Cat. No. 43608, U.S.N.M.

COCCONEIS CIRCUMCINCTA A. Schmidt

See under *C. pellucida* Grunow.

COCCONEIS CITRINA A. Schmidt

(Schmidt, Atlas, pl. 198, figs. 28–30.)

See remarks under next species.

COCCONEIS CITRONELLA, new species?

Plate 13, figs. 3–6

Valves broadly oval with apiculate apices; lower valve with delicate radiating beaded lines closely set, slightly more evident in a band near each margin, otherwise very obscure and misty; almost reaching the rhaphe but lacking on either side of the central nodule, so that a hyaline stauros is produced which is about one-fifth the width of the valve; upper valve with widely set rows of coarse rectangular beads radially arranged and slightly curved toward the two apices, the outer beads of these rows next to the margins of the valve being plainly larger than the others; a hyaline median line corresponding to the rhaphe line of the lower valve.

Length of valve 0.062–0.070; width of valve 0.034–0.039; lines on upper valve 6.5 in 0.01 mm.; lines on lower valve 21–25 in 0.01 mm.

Great confusion exists about this and some similar species, as the result of Cleve's arbtirary grouping of several dissimilar forms under *Achnathes mammalis* (Castracane) Cleve in his Naviculoid Diatoms, volume 2, page 187, plate 3, figures 13–16. His name is based on *Rhaphoneis mammalis* Castracane (Chall. Exp., p. 48, pl. 26, fig. 3) which, although not a *Rhaphoneis*, is equally not an *Achnanthes*. But more important is it that both from the figure and the ample description of Castracane, it is evident that we have there a valve with coarse *unbeaded costae*, in no respect like Cleve's diatom except in the similarity of outline. Cleve's form seems to be the same as the diatoms figured in Schmidt's Atlas, plate 198, figures 35, 36, 40, all from Yokohama and all left unnamed by Schmidt. It might be possible to consider these as varieties of *Cocconeis citrina* A. Schmidt, as figured in his Atlas, plate 198, figures 28–30, except that the lower valve of the species as shown in figure 30 is very different. The beading also is less rectangular and more widely spaced, and there is not a trace of the minute double lines of beading shown in Cleve's figure 14. It is also significant that Schmidt himself does not include them in his *C. citrina*. It may be added that *C. citrina* also occurs in the Philippine Islands and is included in this report. There also is no good reason for Cleve including with these *Stauroneis apiculata* Greville (figured in Greville's Diat. Cal. Guano, pl. 4, fig. 8), a species which Schmidt more reasonably makes *Cocconeis apiculata* (Greville)

A. Schmidt and illustrates in the latter's Atlas, plate 198, figures 31–32. A further addition to the Cleve muddle, but for which he was less responsible, is his adding to the above *Stauroneis obesa* Greville, as given in Greville's Diatoms from the South Pacific, page 237, plate 3, figure 12. In fact the under valve of *C. citronella* Mann and *S. obesa* Greville are so remarkably alike at first sight that Cleve would have needed to compare actual specimens of the two to realize their difference. I have accordingly here illustrated the true *S. obesa*, renamed *Navicula obesa* (Greville) Mann, and also a variety of it, for the purpose of comparison. It will be seen that the lines of beading of *N. obesa* are much coarser than in *C. citronella* and differently arranged at the center of the valve. The measurements of the lines are, *C. citronella* 21–25 in 0.01 mm., and *N. obesa* 9.2–9.4 in 0.01 mm., the two diatoms being almost the same size. But what settles the matter is that in *N. obesa* both valves are exactly alike and both have rhaphes. The specimen here figured is a complete frustule and shows this fact plainly. Doubtless Greville saw this and was certain of the *Navicula* (*Stauroneis*) character of his specimen, a concession to that able diatomist that Cleve failed to make. It may be here added that Castracane's "*Rhaphoneis mammalis*" is probably a synonym of *Cocconeis robustus* Leuduger-Fortmorel in Diatoms of Ceylan, plate 1, figure 1, and that the unnamed figure in Schmidt's Atlas, plate 198, figure 41, is a phase of the same diatom.

Type.—Cat. No. 43609, U.S.N.M.

COCCONEIS COMPOSITA A. Schmidt

(Schmidt, Atlas, pl. 196, figs. 4–5.)

This is rather close to *C. heteroidea* Hantzsch and could be so classified as a well-marked variety.

COCCONEIS CURVIROTUNDA Tempère and Brun

(Brun, Diat. Jap., p. 32, pl. 8, fig. 6; Schmidt, Atlas, pl. 195, figs. 12–16.)

This also is close to *C. heteroidea* Hantzsch; De Toni (Syl. Alg., p. 456) considers it to be intermediate between *C. heteroidea* and *C. pellucida* Grunow.

COCCONEIS CYCLOPHORA Grunow

(Van Heurck, Synopsis, pl. 30, figs. 24–25; Schmidt, Atlas, pl. 197, figs. 20, 26, 30.)

COCCONEIS DISTANS Gregory

(Gregory, Glenshira, Diat., pl. 4, fig. 9; Diat., Clyde, pl. 1, fig. 23; H. L. Smith, Types, No. 70.)

An enormous number of species has been grouped by De Toni and others under the very variable *C. scutellum* Ehrenberg, of which this is one. Without passing judgment on the others, I am sure this species can not be so disposed of without rendering more difficult its identification, a use which I hold to be at present the principal one in diatom taxonomy.

COCCONEIS DIVISA A. Schmidt

(Schmidt, Atlas, pl. 198, fig. 12.)

COCCONEIS FULGUR Brun

(Brun, Espec. Nouv., pl. 18, fig. 3; Schmidt, Atlas, pl. 198, figs. 20–21, doubtful.)

COCCONEIS HETEROIDEA Hantzsch

(Schmidt, Atlas, pl. 196, figs. 31–41; H. L. Smith, Types, No. 73.)

COCCONEIS INSIGNIS Janisch

(Schmidt, Atlas, pl. 197, figs. 2–3.)

COCCONEIS OCELLATA, new species

Plate 14, fig. 1

Valve broadly oval, covered with somewhat wavy rows of closely set beading, the spaces between the rows about equal to them in width; progressively curved away from the center as they approach the ends of the valve, reaching from the margin to the rhaphe line and therefore leaving no hyaline space on either side of the rhaphe; near the margin the rows regularly but not invariably fork into two smaller rows, thereby producing a border effect along the margin; markings of upper and under valves the same; a large, evident, but indistinctly outlined ocellus set to one side of the middle of the valve, smaller and less distinct on the under valve.

Length, 0.062–0.082; width, 0.048–0.062 mm.; lines, 5.5 in 0.01, at the rhaphe.

Type.—Cat. No. 43610, U.S.N.M.

COCCONEIS OCULUS-CATI Brun

(Brun, Espec. Nouv., p. 17, pl. 18, fig. 5.)

Schmidt's *C. hospes* (Atlas, pl. 198, figs. 4–6) resembles this species, but is probably distinct.

COCCONEIS OS-PRISTIS, new species

Plate 14, fig. 2

Valve oval in general shape, but somewhat angular in outline, the sides being slightly convex until within one-third of the apex, then bent at an obtuse angle and continuing straight to the sharp but not produced apex; strong, smooth radiating costae tapering inward, swollen at the marginal ends to semibeads, the pointed inner ends not approaching the rhaphe line but leaving a spindle-shaped central hyaline area reaching to the two apices and about equal in width to the costal area on either side; costal marking alike on both valves.

Length, 0.065–0.070; width, 0.035–0.037 mm.; lines, 3.6–4 in 0.01 mm.

Type.—Cat. No. 43611, U.S.N.M.

COCCONEIS PELLUCIDA Grunow

(Hantzsch, Diat., Ostind., pl. 6, fig. 11; Schmidt, Atlas, pl. 194, fig. 27; pl. 195, fig. 3.)

Although De Toni notes the similarity between this and *C. pseudomarginata* Gregory, his not uniting them is probably right. But he removes from this Grunow's figure in Neue and Ungenügend Diatomaceen, plate 13, figure 6, and puts it in *C. pseudomarginata* Gregory (Syl. Alg., pp. 455, 457).

COCCONEIS PINNATA Gregory

(Micro. Journ., 1859, p. 79, pl. 6, fig. 1; Schmidt, Atlas, pl. 189, figs. 1–5; pl. 190, fig. 3.)

De Tonti can not be sustained in placing this under *C. brundusiaca* Rabenhorst (Rabenhorst, Suss. Diat., pl. 3, fig. 16.)

COCCONEIS PSEUDOMARGINATA Gregory

(Gregory, Diat., Clyde, pl. 9, fig. 27; Schmidt, Atlas, pl. 194, figs. 5–7; H. L. Smith, Types, No. 74.)

COCCONEIS TRANSVERSA A. Schmidt

(Schmidt, Atlas, pl. 196, fig. 39.)

Genus COSCINODISCUS Ehrenberg

COSCINODISCUS AFRICANUS Janisch

(Janisch, Gaz. Exp., pl. 3, fig. 2; Schmidt, Atlas, pl. 59, figs. 24–25.)

COSCINODISCUS APOLLINIS Ehrenberg

(Ehrenberg, Mikrogeologie, pl. 35A, sec. 22, fig. 4.)

There is not much doubt that this and *C. scintillans* Greville (Quart. Journ. Micro. Soc., 1863, p. 230, pl. 10, fig. 6) are the same (see Rattray, Rev. Cosc., p. 578). My specimen agrees fully with that in Schmidt's Nordseefahrt Diatomaceen, plate 3, figure 33, to which Rattray attaches the varietal name, *compacta.* Greville's type came from the fossil bed at Cambridge, Barbados, and Ehrenberg's from a dredging in the Antarctic, while Grove reports it from the fossil deposit of Oamaru, New Zealand, a rather strikingly wide distribution in time and space. The very similar *C. galapagensis* Rattray, figured as *C. griseus* Greville, in Van Heurck's Synopsis, plate 128, figure 7, and plate 132, figure 1, led me in my Diatoms of the Albatross Voyages (p. 252) to place this variety of *apollinis* with it. Although difficult to separate these two, their union was hardly justified. Rattray is correct in throwing out of this combination "*C. scintillans* Greville" in H. L. Smith's Types, No. 99.

COSCINODISCUS ASTEROMPHALUS Ehrenberg

(Ehrenberg, Mikrogeologie, pl. 18, fig. 45; Schmidt, Atlas, pl. 63, figs. 5, 12, and pl. 113 ,fig. 23.)

A species of cosmopolitan distribution, and although showing correspondingly wide variation, too frequently mixed with other names which ought to be kept separate, as *C. biangulatus* A. Schmidt, *C. omphalanthus* Ehrenberg, *C. centralis* Ehrenberg, etc. Of course species are hard to outline sharply in this huge genus because of the comparative simplicity of pattern on which all are built; and it is therefore largely a matter of conjecture where the specific boundaries will run. Thus, although the type form of *C. oculus-iridis* of Ehrenberg is quite different from the type form of this species, one meets with intermediate forms that might as well go into one species as the other.

COSCINODISCUS CENTRALIS Ehrenberg

(Ehrenberg, Mikrogeologie, pl. 18, fig. 39; pl. 22, fig. 1; Gregory, Diat. Clyde, pl. 11, fig. 49.)

COSCINODISCUS CERVINUS (Brightwell) Ralfs

See *Hyalodiscus cervinus* Brightwell.

COSCINODISCUS CILIATUS, new species

Plate 14, fig. 3

Valve circular, barely convex until near the margin, then strongly so; covered with radiating rows of closely set beading uniform in in size; the three or four beads in each row nearest to the margin are perhaps slightly smaller than the others; no hyaline central space, or definite rosette; two rows of fine but evident spines close to the margin, pointed outward, those in one row generally alternating with those in the other; rim strong and hyaline.

Diameter, 0.082–0.087 mm.

Karsten's *C. horridus* (Valdivia Exp., pl. 5, fig. 9) is nearest to this handsome form.

Type.—Cat. No. 43612, U.S.N.M.

COSCINODISCUS CONCINNUS W. Smith

(Quart. Journ. Micro. Sci., 1858, pl. 3, fig. 12; Pritchard, Inf., pl. 5, fig. 89; Schmidt, Atlas, pl. 113, fig. 8.)

This species is of very wide distribution and of bewildering complexity of synonyms. There is also a wide range of difference in size and in the fineness of the areolation. The prevailing Philippine Islands form is small but robust and coarsely netted. Whether or not the original type has the two blunt marginal processes, set apart at about two-fifths of the circumference, which is the most characteristic mark of this species, I do not know, not having access to Smith's specimen; but his figure fails to show it; as do some other of the earlier illustrations. Without these it is easily confused with delicate specimens of *C. centralis.* Its color when dry has no distinctive valve, yellow, buff, brown, and even blue-green valves being present in the same slide.

COSCINODISCUS DENTICULATUS Castracane

(Castracane, Chall. Exp., pl. 3, fig. 8; Rattray, Rev. Cosc., p. 83.)

COSCINODISCUS EXCENTRICUS Ehrenberg

(Ehrenberg, Mikrogeologie, pl. 18, fig. 32, pl. 21, fig. 6; Schmidt, Atlas, pl. 58; figs. 46–49; Van Heurck, Synopsis, pl. 130, figs. 4, 7. 8.)

COSCINODISCUS EXIGUUS Rattray

(Schmidt, Atlas, pl. 58, fig. 30 (no name); Rattray, Rev. Cosc., p. 130.)

This is another species peculiar to both Campeche Bay and the Philippine Islands.

COSCINODISCUS GAZELLAE Janisch

(Grunow, Diat., Casp. Meere (Kittons's translation) in Journ. Roy. Micro. Soc., 1879, pl. 21, fig. 8; Castracane, Chall. Exp., pl. 14, fig. 4 (no name); Rattray, Rev. Cosc., p. 98.)

There is no adequate description and no good illustration of this remarkable diatom. The figure in the Report of the *Challenger* Expedition is a mere fragment of the valve and that in Kitton's translation is indistinct. Nor is there much help to be obtained from the "*Ethmodiscus*" figures in the Report of the *Challenger* Expedition (pl. 14, fig. 3, 4*a*–4*c* (not 4), 5, 6; pl. 22, fig. 10) which Rattray huddles together as synonyms of this species (see Rattray, Rev. Cosc., p. 98). The diatom is almost impossible to find unbroken, though it is abundant in the Philippine Islands, because of its enormous size and its extremely fragile character. Its most striking mark of distinction is the many short wavy lines running transversely across the delicate radiating beading of the valve, this cross-hatching becoming more abundant toward the the margin. This is well shown in the unnamed fragment in the above-mentioned Report of the *Challenger* Expedition (pl. 14, fig. 4; not 4*a*–4*c*). By this it may be easily distinguished from the somewhat smaller *C. rex* Wallich, as well as by the absence of the cluster of papillae in the central area of the latter.

COSCINODISCUS HETEROMORPHUS Rattray

(Schmidt, Atlas, pl. 65, fig. 17 (no name); Rattray, Rev. Cosc., p. 468 (p. 20).)

It bears considerable resemblance to *C.spendidus* Greville as shown in the Microscopical Journal for 1865, plate 5, figure 3, but not to the figure in Schmidt's Atlas, plate 65, figure 11. Only one, but an unmistakable specimen, of this diatom was found, the type of which is marked as coming from "Piscataway."

COSCINODISCUS JANISCHII A. Schmidt

(Schmidt, Atlas, pl. 64, figs. 3–4.)

COSCINODISCUS KUETZINGII A. Schmidt

(Schmidt, Atlas, pl. 57, figs. 17–18; Gran, Nord. Plank., p. 36, fig. 38.)

COSCINODISCUS LENTIGINOSUS Janisch

(Janisch, Gaz. Exp., pl. 5, fig. 7.; Schmidt, Atlas, pl. 58, fig. 11.)

COSCINODISCUS LEPTOPUS Grunow

(Van Heurck, Synopsis, pl. 131, figs. 5–6.)

This is easily confused with *C. lineatus* Ehrenberg, which see.

COSCINODISCUS LINEATUS Ehrenberg

(Ehrenberg, Mikrogeologie, pl. 18, fig. 33; pl. 22, fig. 6*a*, *b*; Van Heurck, Synopsis, pl. 131, fig. 3; Schmidt, Atlas, pl. 59, figs. 27, 32.)

If there were need to select the the six most important diatoms this would be one. Its present geographical distribution is almost universal; and its general presence in fossil deposits from all parts of the world indicates it is one of a few species that have held their type characteristics unchanged from the beginning. Whether or not certain forms similar to it have branched off from it as the parent stock, it is at present impossible to say. But the resemblance of *C. excentricus* and *C. leptopus* to it is worthy of comment, when taken in connection with the fact that one does find occasionally individuals in which the linear network is disturbed so as to duplicate that of *C. excentricus*, and also there occur cases in which the single rod-like process on the margin of *C. leptopus* can be discovered on the margin of this species. The above figures in Van Heurck and in Schmidt's Atlas will enable one to distinguish between these similar forms.

COSCINODISCUS MARGINATUS Ehrenberg

(Ehrenberg, Mikrogeologie, pl. 18, fig. 44; pl. 33, sec. 12, fig. 13; Schmidt, Atlas, pl. 62, figs. 1–5.)

For a discussion of the haphazard use of this name and *Coscino discus robustus* Greville, see Mann's Diatoms of the Albatross Voyages, page 254. There are also some figures bearing this name which clearly belong to other species; for example, the one in Schmidt's Nordseefahrt Diatomaceen, plate 3, figure 35, which is *C. kutzingii* A. Schmidt.

As bearing on this subject it may be here stated, that a recent examination of many specimens of *Coscinodiscus robustus* Greville, collected in Monterey Bay, Calif., the original locality of Greville's type specimen, unmistakably shows that it is not a *Coscinodiscus* but an *Endictya*. This fact will be set forth in an illustrated article now under preparation. Meanwhile a study of Greville's figure in Microscopial Journal for 1865, plate 1, figure 8, as well as the one in Schmidt's Atlas, plate 65, figure 9, called *C. subvelatus* Grunow, also from Monterey, and the unnamed figure in Schmidt's Atlas, plate 62, figure 16, from Monterey, will make evident how *Endyctia*-like these illustrations really are. That the true generic character of that diatom was not long ago suspected is due to the fact that Greville's type specimen is lost, as stated by Rattray, and further, the lack of any illustration of the girdle view of the diatom, which is typically that of *Endictya*.

COSCINODISCUS MICANS A. Schmidt

(Schmidt, Atlas, pl. 139, figs. 2–3.)

C. radiosus Grunow, especially as figured by Janisch (Gaz., Exp., pl. 5, fig. 9) is rather close to this.

COSCINODISCUS NANO-LINEATUS, new species

Plate 14, fig. 4

Valve circular, moderately convex to the margin; areolation linear, not radiating, the beads largest at the center and closely set, slightly decreasing toward the margin and proportionally more widely spaced; a single row of short, stout, sharply pointed spines next to the margin and pointing outward.

Diameter, 0.027 mm.

This appears to be essentially the species represented by the unnamed figure in Janisch's Diatoms of the Gazelle Expedition, plate 20, figure 16. It is also like the doubtful example of *C. lineatus* Ehrenberg in Schmidt's Atlas, plate 59, figure 30, except that *lineatus* is not at all convex, its areolation is not progressively smaller from center to margin and the apiculi are minute or absent. To unite the above uniformly unlike and minute species with *C. lineatus* is therefore to negative most of the specific characters of the latter. In fact, Schmidt in his Atlas, plate 114, figure 13 declines to unite the form there figured with *C. lineatus* solely on the ground of its convexity, a procedure which is perhaps to arbitrary and is rejected by Rattray in his Revision of the *Coscinodiscus* (p. 473).

Type.—Cat. No. 43613, U.S.N.M.

COSCINODISCUS NITIDULUS Grunow

(Schmidt, Atlas, pl. 58, figs. 20–21; Van Heurck, Synopsis, pl. 132, fig. 2.)

This is another species common to Campeche Bay and the Philippine Islands.

COSCINODISCUS NITIDUS Gregory

(Gregory, Diat., Clyde, p. 27, pl. 10, fig. 45; Schmidt, Atlas, pl. 58, fig. 18.)

COSCINODISCUS NOBILIS Grunow

(Grunow, Diat., Casp. See (Kitton's Translation) in Journ. Roy. Mic. Soc., 1879, pl. 1, fig. 1; Janisch, Gaz. Exp., pl. 2, fig. 6; pl. 6, fig. 13.)

COSCINODISCUS NODULIFER Janisch

(Schmidt, Atlas, pl. 59, figs. 20–23.)

COSCINODISCUS NORMANII Gregory

(Micro. Journ., 1859, p. 80, pl. 6, fig. 3; Schmidt, Atlas, pl. 57, figs 9–10, misnamed.)

COSCINODISCUS OCULUS-IRIDIS Ehrenberg

(Ehrenberg, Mikrogeologie, pl. 18, fig. 42; pl. 19, fig. 2; Schmidt, Atlas, pl. 63, figs. 6, 7, 9; pl. 113, figs. 1, 3–5, 20.)

Ehrenberg's *C. centralis*, figured in Mikrogeologie, plate 18, figure 30, and plate 22, figure 1, is quite distinct from this; but what he calls by that name in plate 21, figure 3 is probably this species. The same is true of what Castracane misnames *C. centralis* in the Reports of the Challenger Expedition, plate 2, figure 3.

COSCINODISCUS PRAETEXTUS Janisch

(Janisch, Gaz. Exp., pl. 3, fig. 4.)

Rattray is wrong in maming this the same as *C. gigas* Ehrenberg. See Ehrenberg's Mikrogeologie, plate 18, figure 34.

COSCINODISCUS PUSTULATUS Mann

(Mann, Diat., Albatross Voyages, p. 257, pl. 48, fig. 3.)

COSCINODISCUS RADIATUS Ehrenburg

(Ehrenberg, Mikrogeologie, pl. 19, fig. 1; pl. 22, fig. 3; Schmidt, Atlas, pl. 60, figs. 5, 6, 9; pl. 62, fig. 18.)

I do not agree with De Toni (Syl. Alg., p. 1246) that *C. devius* A. Schmidt in his atlas, plate 60, figures 1–4, is a small variety of this species

COSCINODISCUS RADIOSUS Grunow

(Van Heurck, Synopsis, pl. 132, fig. 7.)

As noted under *C. micans* A. Schmidt, it and this species are similar.

COSCINODISCUS RENIFORMIS Castracane

(Castracane, Chall. Exp., p. 160, pl. 12, fig. 12. See Janisch, Gaz. Exp., pl. 1, figs. 1–5, and Schmidt, Atlas, pl. 140, fig. 17, misnamed.)

This strangely shaped diatom is rather widely distributed and, though varying somewhat in contour and fineness of network, keeps closely to its type. It is a radically distinct species in the genus

Coscinodiscus; but it can no more be separated from that genus because of its contour, whether studied in its valve or in its girdle aspect, than can *Surirella reniformis* Grunow be separated from *Surirella.* Rattray is therefore right (Rev. Cosc., p. 548) in preferring the above name, rather than *Stoschia admirabilis* Janisch issued in his manuscript of the Diatoms of the Gazelle Expedition (1888) and accepted by Schmidt in his Atlas, plate 140, figure 17 (1889). Castracane's name was published in 1887.

COSCINODISCUS REX Wallich

(Schmidt, Atlas, pl. 114, fig. 7.)

This diatom is so fragile that its presence in some gatherings probably remains undetected despite its huge size.

COSCINODISCUS SCITULUS, new species

Plate 14, fig. 5

Valve circular, flat to within one-third of the radial length from the margin, then strongly convex for a half of that distance, whence it slopes gently down to the margin; the entire valve covered with radiating rows of beads equal in size; no central hayline area or rosette, but the beading of the secondary rows so falling short in approaching the center as to leave narrow vacant lines and thereby to produce the "sunburst" effect characteristic of the genus *Actinocyclus*; near the margin one or two rows of fine spines irregularly placed, and next to the rim a strong row of short, heavy, blunt processes extending across the rim, thereby giving to it the aspect of being divided into scallops.

Diameter, 0.052 mm.

There is a slight resemblance between this and *C. bullatus* Janisch (Gaz. Exp., pl. 6, fig. 12).

Type.—Cat. No. 43614, U.S.N.M.

COSCINODISCUS SUBTILIS Ehrenberg

(Ehrenberg, Mikrogeologie, pl. 18, figs. 35*a–b*; Schmidt, Atlas, pl. 57, figs. 11–13, 28, 29; Van Heurck, Synopsis, pl. 131, fig. 1.)

A species of very wide distribution and great variability.

COSCINODISCUS SYMMETRICUS Greville

(Micro. Journ., 1861, pl. 8, fig. 2.)

De Toni (Syl. Alg., p. 1229) excludes the figures bearing this name in Schmidt's Atlas, plate 57, figures 25–27, and probably rightly so.

COSCINODISCUS TUBIFORMIS Tempère and Brun

(Brun, Diat., Jap., p. 34, pl. 7, fig. 6; Schmidt, Atlas, pl. 164, fig. 1.)

The finding of a specimen of this diatom in a Philippine Islands dredging increases a doubt I have had for some time of its being anything but a small and robust form of some other species, for example

C. marginatus Ehrenberg. It occurs also in the marine fossil deposit at Lompoc, Calif., and abundantly in a living state in Bering Sea.

COSCINODISCUS VARIOLATUS Castracane

(Castracane, Chall. Exp., p. 155, pl. 2, fig. 5.)

I hardly feel ready to accept Rattray's contention that this is only a variety of *C. denarius* A. Schmidt. (See Rattray, Rev. Cosc., p. 57, and compare with Schmidt, Atlas, pl. 57, figs. 19–21.) But if this is so, it is another case where the same diatom is common to Campeche Bay and the Philippine Islands. Castracane's type came from the Philippine Islands and *C. denarius* is reported by Schmidt from Campeche Bay.

Genus CRASPEDODISCUS Ehrenberg

CRASPEDODISCUS INSIGNIS A. Schmidt

(Schmidt, Atlas, pl. 66, fig. 2.)

A study of this diatom suggests the question if this is not better regarded as a species of *Endictya.*

Genus CYCLOTELLA Kutzing

CYCLOTELLA CRASSILINEATA, new species

Plate 14, fig. 6

Valve circular, somewhat transversely undulate; an outer area, forming a band one-third the radius in width, strongly marked with closely set radiating moniliform costae, their beading being rather widely separated; within this band a circular central area, sparsely punctate with irregular dots.

Diameter 0.039 to 0.051 mm.

Type.—Cat. No. 43615, U.S.N.M.

CYCLOTELLA STRIATA (Kutzing) Grunow

(Van Heurck, Synopsis, pl. 92, figs. 6–10, 12–15; Schmidt, Atlas, pl. 223, figs. 9–20.)

Genus CYMATONEIS Cleve

CYMATONEIS CIRCUMVALLATA Cleve

(Schmidt, Atlas, pl. 212, fig. 48.)

It seems to me Cleve's removal of this diatom and *C. sulcata* from *Navicula* into his new genus, *Cymatoneis,* is an aid to classification, although he subsequently abandoned the idea. It is one of the few proposed new genera into which he tried to break up the unwieldy genus *Navicula* that seems to be sufficiently unlike the typical *Navicula* structure to be safely usable. It certainly is no more like the *Navicula* image, as it has gradually shaped itself in the minds of diatomists, than *Scoliopleura* or *Brebissonia* or *Tropidoneis.* Its sharply defined central area, its sigmoid shape, its unique rhaphe terminating at each end in a spine, and its sui generis style of beading give to it an unlikeness to what we picture as a "*Navicula*" and make its new classification a convenience to the taxonomist. Nor does it seem to me to signify that each of these marks of distinction may be found separately in some aberrant species of *Navicula;* for the same contention would destroy a good many accepted genera.

CYMATONEIS DEFINITA, new species

Plate 15, fig. 1

Valve prismatic-elliptical, its side nearly straight from the wide middle to the blunt apices, these being not at all produced; the narrow elliptical median area only slightly elevated above the rest of the valve at its two extremities and none at its middle; the entire valve, including the median area, covered with coarse rows of beading, the beads closely set in each row, the rows well separated, the beading so evenly arranged as to show false longitudinal striation as well as the cross striation; this striation tranverse at the middle, increasingly radial toward the apices, and there arranged fanwise; rhaphe straight, terminating outwardly in two long straight spines, its inner ends actually overlapping, the tips bent to opposite sides.

Length, 0.110; width, 0.046; lines, 4.2 in 0.01 mm.

Type.—Cat. No. 43616, U.S.N.M.

CYMATONEIS LACUNATA, new species

Plate 15, fig. 2

Valve oval, strongly convex, modified by a shoulder close to each apex, the apices bluntly rounded; markings of transverse, closely set rows of beading, leaving a narrow, somewhat sigmoid, perfectly hyaline central area, which is bisected by the sigmoid rhaphe, at the two extremities of which are two strong pointed spines, obliquely turned outward; beading so regularly spaced in the rows that they fall into longitudinal as well as transverse lines.

Length, 0.053–0.096; width, 0.029–0.045; lines, 6.5–7.5 in 0.01 mm.

Type.—Cat. No. 43617, U.S.N.M.

CYMATONEIS SUFFLATA, new species

Plate 15, fig. 3

Valve elliptical or subrectangular, with barely convex sides, quickly rounded up to the produced papillate apices; central area elevated, extending to the apices, marked like the rest of the valve, except for a narrow hyaline area on either side of the rhaphe and a slightly enlarged hyaline area about the central nodule; these valve markings strong, of closely set rectangular beads in transverse rows, becoming slightly curved and radial toward the apices, showing longitudinal lines, which become slightly incurved toward the apices and thereby preserve the right-angle crossing of the two sets of lines; rhaphe practically straight and having a distinct oblique spine at each outer end.

Length, 0.039; width, 0.023; lines, 9.5 transverse and 10 vertical in 0.01 mm.

Type.—Cat. No. 43618, U.S.N.M.

CYMATONEIS SULCATA (Greville) Cleve

(Cleve, Nav. Diat., vol. 1, p. 75, pl. 1, figs. 12–13; Schmidt, Atlas, pl. 212, figs. 41–45.)

This is another species found at both Campeche Bay and the Philippine Islands.

Genus CYMBELLA Agardh

CYMBELLA EHRENBERGII Kützing

(Schmidt, Atlas, pl. 9, figs. 6–9, 16–18; Van Heurck, Synopsis, pl. 2, figs. 1–2.)

CYMBELLA GASTROIDES Kützing

(Schmidt, Atlas, pl. 9, figs. 1–2; Van Heurck, Synopsis, pl. 2, fig. 8; H. L. Smith, Types, No. 118.)

Genus DIMEREGRAMMA Ralfs

DIMEREGRAMMA BILINEATUM (Cleve and Grunow) Mann

Plate 15, fig. 4

(Cleve, Vega Diat., p. 499, pl. 37, fig. 55.)

The doubt of this being a *Rhaphoneis* expressed by the authors, is well founded. A careful study convinces me it is better classified in the present genus. A form found in the Philippine Islands is either a very dissimilar variety from those figured by Cleve, or preferably should be made into a separate species. In this case it may be called—

DIMEREGRAMMA FLUENS, new species

Plate 15, fig. 5

Valve nearly rod shaped, but gracefully undulate by being broadly constricted at the middle and tapering gently to the rounded ends; a double row of course rectangular beads on either side next to the margin until near the ends they become single rows, each bead marked with one or two dots; central area narrow, tapering, not constricted; apices slightly elevated, massive, hyaline.

Length 0.105; width 0.012; 7 lines in 0.01 mm.

Type.—Cat. No. 43619, U.S.N.M.

DIMEREGRAMMA INFLATUM Mann

(Mann, Diat., Alb. Voyages, p. 327, pl. 44, fig. 6.)

For a discussion of the relationship of this to Gregory's *Denticula marina*, see the above reference.

DIMEREGRAMMA MINOR (Gregory) Ralfs

(Van Heurck, Synopsis, pl. 36, figs. 10–11*a*; Gregory, Diat., Clyde, pl. 2, fig. 35.)

DIMEREGRAMMA NANUM (Gregory) Ralfs

(Pritchard, Inf., p. 790, pl. 4, fig. 33; Van Heurck, Synopsis, pl. 36, fig 11.)

DIMEREGRAMMA OPULENS, new species

Plate 15, figs. 6–7

Valve elongated, naviculoid, constricted at the middle, then enlarged and again constricted, whence the sides either run parallel to the rounded apices or slightly approach each other; the entire valve, except the apices, crossed transversely by massive moniliform costae, divided into four parts by three narrow longitudinal lines, two of them midway between the center and the sides, and one median line; each of the four parts thus formed is two or three beads wide; apices elevated above the rest of the valve, almost hyaline, but obscurely marked with fine radiating beading.

Length, 0.056–0.079; width, 0.014–0.017; costae, 5.5 in 0.01 mm.

Type.—Cat. No. 43620, U.S.N.M.

DIMEREGRAMMA PRISMATICUM, new species

Plate 15, fig. 8

Valve elliptical, prismatic, with acute apices; sides parallel at the middle for one-third the length of the valve, then converging in straight lines to the acute but rounded apices; valve transversely crossed by heavy moniliform costae unequally divided into four parts by three longitudinal and narrow lines, the median line being widest at the center and narrowing toward the apices; the two outer or marginal parts of the four divisions of the costal area one-half the width of the two inner parts, each of the former ornamented with two beads and each of the latter with four beads; apical area small, triangular, elevated above the rest of the valve, and hyaline.

Length 0.045; width 0.017; costae 5 in 0.01 mm.

Type.—Cat. No. 43621, U.S.N.M.

Genus DITYLUM Bailey

DITYLUM BRIGHTWELLII (West) Grunow

(Van Heurck, Synopsis, pl. 114, figs. 3–9; Micro. Journ., 1860, pl. 8, figs. 1, 5, 8.)

It is not advisable to change Bailey's spelling of the generic name to *Ditylium.*

Genus DONKINIA Ralfs

For a discussion of the reasons for separating this and *Rhoicosigma* from *Pleurosigma* see under those two genera.

DONKINIA CARINATA (Donkin) Ralfs

(Pritchard, Inf., p. 921, pl. 8, fig 49; H. L. Smith, Types, No. 143; Peragallo, Pleuro., pl. 9, fig. 6.)

DONKINIA RETICULATA Norman

(Greville, Diat., So. Pacific, pl. 3, figs. 13–14; Peragallo, Pleuro., pl. 9, fig. 2.)

Greville's figure is ideal and Peragallo's poor.

ECHINODISCUS, new genus

Valve circular, slightly convex to the elevated rim, then turned vertically downward to form deep sides perpendicular to the central portion of the valve, and finally expanded into a narrow hyaline flange, where the valve joins the girdle; central portion of the valve irregular, covered with circular splotches united by veriform lines into larger or smaller patches, thickly (but irregularly) scattered over the surface; the elevated rim and the vertical sides of the valve closely covered with a fringe of irregularly shaped prickles, and at one point on the rim a broad lunate or hemispherical process.

ECHINODISCUS VERMICULATUS, new species

Plate 16, fig. 1

Characters those of the genus.

Diameter 0.169 mm.; depth of vertical side 0.01 mm.

It is probable that the two unnamed figures in Schmidt's Atlas plate 164, figure 6 and plate 202, figure 3, from the near-by locality of Jeddo, Japan, are examples of the same genus. If so, the vermiculate character of the markings here represented can be looked upon as a somewhat abnormal phase of the more regular radiating pattern shown in Schmidt's two figures. In that case, the specific name here given should apply only to the spines or prickles covering the rim and sides. It is evident that none of these forms can be referred to the genus *Stephanopyxis*, as Schmidt suggests. A much closer, affinity exists between this and *Endictya*, to which further specimens may prove it belongs. The above-mentioned lunate process on the rim, in that view of the case, would only be an aberrant occurrence confined to those clearly fantastic specimens. I have, however, thought best to represent this interesting diatom exactly as it is, leaving its validity subject to the foregoing remarks.

Type.—Cat. No. 43622, U.S.N.M.

Genus ENDICTYA Ehernberg

ENDICTYA MARGARITIFERA, new species

Plate 15, figs. 9–10

Surface of the valve barely concave to the rim, which is elevated above the inner portion and sharply turned downward to form the deep vertical sides, to the lower edge of which the girdle is attached; both the circular portion of the valve included within the rim and the vertical sides or flange are ornamented with massive, polished disks or flattened beads, irregularly placed and variable in size, those near the center usually averaging somewhat the larger; the rim is further ornamented with a row of large, elevated pearls or spherical beads, best seen in the girdle view.

Diameter, 0.096–0.124; width of vertical sides of flange, about 0.037 mm. Beads average 0.006 mm. in diameter.

It is possible the *Endictya* form in Schmidt's Atlas, plate 62, figure 8 (unnamed), from Celibes should be included here, as Schmidt states its rim is ornamented with "zahlreichen knötchen tragenden Stacheln." There is a close but fictitious resemblance to the Philippine Islands form in the Report of the Challenger Expedition (pl. 22, fig. 4); for, if the description on page 162 is taken into account, that diatom has so convex a valve that Castracane suspects it should be placed in (*Stephanopyxis*) *Pyxidicula;* and furthermore, its entire valve is ornamented with "tuberculate processes having hexagonal bases."

It is advisable that the genus *Endictya* shall not be combined with *Coscinodiscus,* as is done by Rattray (Rev. Cosc., p. 450), an arrangement accepted by me in my Diatoms of the Albatross Voyages. It should be retained to accommodate such forms as have valves sharply bent downward at the rim to form vertical sides or flanges at right angles to the surface of the circular portion. This is the position taken by Van Heurck and others. It is, however, further to be said that those forms which Castracane includes in his new genus *Ethmodiscus* should perhaps also be considered to be *Endictyae,* their structure differing from such species as the below *E. oceanica* mainly in the fineness of their markings and the general delicacy of their entire frustules. This would leave for the genus *Coscinodiscus* that large class of diatoms the valves of which, whether flat, concave, or convex, terminate at the rim, where they join the girdle and are not bent vertically down to form deep sides or flanges ornamented with markings continuous with those of the rest of the valve. In fact *Endictya* is much more closely related to *Stephanopyxis,* or even to that subdivision of *Melosira* called *Orthosira* than to *Coscinodiscus.*

Type.—Cat. No 43623, U.S.N.M.

ENDICTYA MINOR A. Schmidt

(Schmidt, Atlas, pl. 65, figs. 14–16.)

Although this species follows very closely the structural plan of the genus type, *E. oceanica,* specimens of it, both fossil and recent, are so uniform that it can not be classed as a small and robust variety of that species. The type of the present species was found at the near-by Celibes Islands.

ENDICTYA OCEANICA Ehrenberg

(Ehrenberg, Mikrogeologie, pl. 35A, sec. 18, figs. 6–7; Schmidt, Atlas, pl. 65, figs. 12–13.)

Genus EPITHEMIA Kützing

EPITHEMIA ZEBRA (Ehrenberg) Kützing

(Smith, Brit. Diat., pl. 1, fig. 4; Van Heurck, Synopsis, pl. 31, figs. 9, 11–14; Schmidt, Atlas, pl. 252, figs. 1–21.)

The natural habitat of this diatom is probably fresh water; but it often occurs in marine gatherings, not as detritus, but as a member of the flora. It also appears in fresh-water fossil deposits. It is rare in the material examined for this paper.

Genus EUODIA Bailey

EUODIA JANISCHII Gurnow

See *Leudugeria janischii.*

Genus FRAGILARIA Lyngbye

FRAGILARIA ANGUSTATA Cleve and Grove

(Le Diat., 1891, pl. 8, figs. 19–20.)

Scarce at the Philippine Islands.

FRAGILARIA DUBIA Grunow

(Grun, Oester. Diat., pl. 7, fig. 28; Van Heurck, Synopsis, pl. 36, fig. 18.)

As the specific name suggests, it is doubtful if this diatom belongs to the genus *Fragilaria.*

Genus GLYPHODESMIS Greville

No adequately sharp line of demarcation between this genus and *Plagiogramma* can be drawn. The ideal *Glyphodesmis* may be said to be *G. williamsonii* (Gregory) Grunow, and the ideal *Plagiogramma, P. validum* Greville, and between these two there is a perfectly satisfactory difference. But this is not maintained between other species of the two genera. The most pronounced mark of demarcation is that *Plagiogramma* has an evident hyaline area across the middle of the valve, often with a ridgelike border, and bearing at its center a large disk or elevation, while *Glyphodesmis* has no hyaline central area; its beading also is heavy, closely set and liable to be quadrate rather than round, as in *Plagiogramma.* But in such forms as *P. tesselatum* Greville the beading is subquadrate and the hyaline central area is reduced to the dimensions of a large oval median disk or pseudonodule. It might be well to put this genus subgenerically under *Plagiogramma,* the older of the two.

GLYPHODESMIS ACUS, new species

Plate 16, figs. 2–3

Valve long, narrowly prismatic, tapering at first rapidly from the broadened angular middle portion and then more slowly to the blunt apices, the two halves frequently (not always) unequal in length; crossed by strictly transverse, fine beaded lines, which are bisected by a delicate longitudinal median line, extending the entire length of the valve; the central knob or elevation is small and difficult to see, except in side view, because of its not being hyaline nor surrounded by a hyaline area, but marked with the same beaded crosslines which cover the rest of the valve; the two apical knobs are small but evident; in side (girdle) view the frustule is seen to be about six times as long as its width, the faces of two attached frustules being well separated, except where they touch at the apices and at the center by their terminal and median knobs.

Length, 0.042–0.068; width, 0.010–0.012; lines, 16–17 in 0.01 mm.

This species might be easily mistaken for a *Fragilaria*, if seen with a low magnification and only in its face view. Its true generic position is however made clear by the side aspect, which is therefore here illustrated. Its minute size makes it easily overlooked, but in many of the Philippine Islands gatherings it is quite abundant, especially in one from Jolo Jolo.

Type.—Cat. No. 43624, U.S.N.M.

GLYPHODESMIS ELONGATA Cleve and Grove

(Le Diat., 1891, pl. 8, figs. 12–14.)

The original came from the near-by Macassar Straits.

GLYPHODESMIS MARGARITACEA Castracane

(Castracane, Chall. Exp., p. 44, pl. 18, fig. 10; Schmidt, Atlas, pl. 209, figs 51–53.)

See remarks under genus above.

Genus GRAMMATOPHORA Ehrenberg

GRAMMATOPHORA FUNDATA, new species

Plate 16, figs. 4–5

Valve flat, but appearing to be crossed by heavy undulations, about 12 to 14, caused by underlying tortuous septa; sides parallel and straight; ends round, generally same width, sometimes slightly swollen; surface of the valve covered with coarsely cut quincunx markings; medial line obscure or absent; median area oval, its longer axis transverse and reaching to the sides; in side (girdle) view the frustule is seen to be three to three and one-half times as long as broad; the tortuous septa are massive, evenly undulating and terminate near the center in heavy blunt, triangular ends.

Length, 0.080–0.205; width, 0.011–0.017; lines, 15 in 0.01 mm.

The nearest affinity is *G. flexuosa* Grunow and less so *G. serpentina* Ehrenberg, and *G. longissima* Petit.

Type.—Cat. No. 43625, U.S.N.M.

GRAMMATOPHORA ISLANDICA Ehrenberg

(Van Heurck, Synopsis, pl. 53, fig. 7.)

GRAMMATOPHORA MARINA (Lyngbye) Kützing

(Smith, Brit. Diat., pl. 42, fig. 314; Van Heurck, Synopsis, pl. 53, figs. 10–11.)

GRAMMATOPHORA OCEANICA Ehrenberg

(Ehrenberg, Mikrogeologie, pl. 17, fig, 87; pl. 19, fig. 36*a*; Van Heurck, Synopsis, pl. 53bis, figs. 15–16.)

GRAMMATOPHORA PROBATA, new species

Plate 16, figs. 6–7

Valve four times laterally constricted, resulting in one central, two terminal, and two intermediate enlargements, which are of equal width, the sinuses between being longer than the enlargements; ends rounded, hyaline; all the rest of the valve surface covered with strong quincunx markings; median line wanting; central area circular, not oval; along each margin fine, short, sharp prickles, extending to (but not around) the rounded ends of the valves; these prickles sometimes entirely absent. In side (girdle) view the two septa are seen to have two soft undulations, the inner ones smaller; ends of the septa slightly enlarged and curved inward toward the girdle line.

Length 0.045–0.093; width 0.010–0.013; lines 14 in 0.01 mm.

The difficulties of uniting this with *G. punctata* Leuduger-Fortmorel as figured and described in Diatomeés d'Afrique, page 21, plate 4, figure 5, are that the African species is much less constricted, is greatly enlarged at the center, is marked with coarse transverse lines, has prominent oval hyaline areas at the two ends, has a very oval central area, and is ornamented along each side with strong beads or pearls, none of which is true of this species. As to the last, it is hardly supposable that Leuduger-Fortmorel mistook for pearls the delicate prickles of the above by seeing them out of focus. Both, however, are so unlike other known examples of this genus that the supposition of their being the same is admissable.

Type.—Cat. No. 43626, U.S.N.M.

Genus GYROPTYCHUS A. Schmidt

See *Actinodiscus* Greville.

Genus HEMIDISCUS Wallich

Wallich's generic name in the Microscopical Journal for 1860 (p. 42) antedates that of Bailey, *Euodia* (Pritchard, Inf., p. 852). It has the incidental advantage of being far more descriptive that *Euodia.* Cleve evidently prefers *Hemidiscus* for regarding "*Euodia arcuata* sp. n" in Schroder's Phytoplankton Napelo he says it is *Hemidiscus cuneiformis.*

HEMIDISCUS CAPILLARIS Brun

(Brun, Espec. Nouv., p. 26, pl. 17, fig. 4.)

HEMIDISCUS CUNEIFORMIS Wallich

(Micro. Journ., 1860, p. 42, pl. 2, figs. 3–4; H. L. Smith, Types, No. 161.)

HEMIDISCUS HARDMANIANUS (H. L. Smith) Mann

(H. L. Smith, Types, No. 287.)

H. L. Smith places this diatom in *Palmeria,* Greville's perfectly unnecessary genus.

HEMIDISCUS INORNATUS Castracane

(Castracane, Chall. Exp., p. 149, pl. 12, fig. 1.)

HEMIDISCUS JANISCHII Grunow

See under *Leudugeria.*

HEMIDISCUS RADIATUS (Castracane) Mann

(Castracane, Chall. Exp., p. 150, pl. 12, fig. 4.)

HEMIDISCUS VENTRICOSUS (Castracane) Mann

(Castracane, Chall. Exp., p. 150, pl. 12, fig. 5.)

HENSHAWIA, new genus

Front (valve) view a narrow ellipse, its long axis three to six times the length of the transverse one, the elliptical outline perfect at the margin of the valve where it joins the girdle, but irregular on the apparent upper plane of the valve, the valve being very deep or convex, as shown in side (girdle) view; a deep groove extends up the sides and across the middle of the valve, dividing it into two symmetrical halves, and in the center of this groove is a rosette of oval beads, the outer ring close set and regular, the inner beads irregularly arranged; the rest of the valve is covered with rows of oval beads, punctate, and with an evident central dot, the rows being symmetrically and radially arranged, with reference to the central rosette; in side (girdle) view the frustule is rectangular, each valve being as deep as it is long, and the two valves being joined by a very broad girdle; the length of the frustule, measured from the outer surfaces of the valves, is therefore two to three times the length of the valves, resembling in this respect some specimens of *Biddulphia pulchella* and "*B. balaena*"; corners of the rectangular frustule not produced, generally broadly rounded, sometimes sharply angular; sides of the valves marked with vertical rows of beads, continuous with the radiating rows of the upper surface, the beads oval or round and punctate; girdle covered with rows of beads continuous with those on the surface of the valves and therefore arranged across the girdle, not around it; its beads smaller than those of the valves and always round; the groove across the center of each valve appears in side view as a deep notch.

This remarkably formed diatom has unmistakable affinities with *Biddulphia*, but is wholly without knobs, horns, or other processes or modifications at the apices of the valves. The type species somewhat suggests "*Biddulphia balaena*" (*Trigonium*) and the now generally discarded genus *Odontella*. But its strikingly different front view, its deep tranverse groove, and the well-marked central rossette of beads make it impossible to refer this form to any known genus.

I take pleasure in naming it after my friend and efficient colaborer, Mr. Henry W. Henshaw, former chief of the United States Biological Survey.

HENSHAWIA BIDDULPHIOIDES, new species

Plate 17, figs. 1, 2

Characters those of the genus.

One of the remarkable things about this diatom is the apparently haphazard variation in the form of the four corners (apices of the two valves) as seen in the side or girdle view. It is not unlikely that the frustules grow in chains, attached by their corners or by the faces of the valves, although no example of this was actually found. But even so, this would not explain the variation of the corners. Usually they are evenly rounded; sometimes, however all four are sharply angular or pointed, and specimens were found with both corners rounded on one valve and both pointed on the other valve of the same frustule. The depth of the frustule, that is, its height as seen in girdle view, also varies greatly. Generally the frustule, is about as broad as high, that is, its depth equals the length of the valves, but small specimens are occasionally four or more times as high as broad, reminding one of occasional small specimens of *Biddulphia pulchella* Gray. Thus a specimen in my collection measures in girdle view 0.034 mm. in width and 0.153 mm. in height.

Length of valve 0.034–0.210; width of valve 0.028–0.039; depth of frustule 0.084 to 0.190 mm.

Generally present in Philippine Islands dredgings and in some abundant.

Type.—Cat. No. 43627, U.S.N.M.

Genus HERCOTHECA Ehrenberg

The strong suspicion that the forms composing this genus are only endocysts escaped from frustules of *Rhizosolenia* or kindred general has resulted in its general abandonment; and it is included here with no actual belief in its validity, but because as yet these bodies are impossible to definitely assign elsewhere. Whether endocysts or not, they represent certain species of diatoms that exist in the flora in which they occur, and should therefore be so included until a better assignment can be made.

HERCOTHECA INERMIS, new species

Plate 18, figs. 1–2

Front views of the two valves dissimilar; both circular, both having the entire surface closely wrinkled into a strong network of anastomosing lines, both with an inner concentric circle and a small central dot or knob; but the inner circle of one valve obscure and near the margin, of the other distinct and midway between the margin and the center; the side (girdle) view explains the difference, one valve being almost evenly hemispherical or dome-shaped, with a slight undulation in the curve near the margin; the other having its hemispherical contour compressed to an almost conical elevation, the basal width of which is one-half that of the valve; girdle narrow, thin, and hyaline.

Diameter, 0.062–0.073; width of frustule, 0.053–0.059 mm.

Although this species shows no trace of the circle of spearlike spines which arise vertically from each valve of the uncommon genus *Hercotheca* in each of its two known species, *H. mammillaris* Ehrenberg (Mikrogeologie, pl. 33, sec. 18, fig. 7; Pritchard, Inf., pl. 7, fig. 35) and *H. brevispina* Grunow (Cleve and Moll, Diat., No. 215) it differs in no other essential respect. In fact the side views are otherwise identical, and the chief characteristic, the dissimilarity of the two valves, is quite pronounced. Therefore, although a new genus was planned to receive this unique form, the interests of taxonomy seem to be better met by assigning it to *Hercotheca.*

As mentioned above, the assumption may be made that it is an ornate and unusually large example of endocyst of some cylindrical diatom, like *Rhizosolenia;* and there is a possibility that future research may prove it to be so. But although this form is frequent in several Philippine Islands dredgings and the dominant object in one of them, I have not been able to find a trace of any diatom to which it can be referred. If one were to suppose that the investing diatom was so delicate and pellucid as to escape detection in examinations of the uncleaned material and to be entirely obliterated by the acid process of cleaning, the classification of this form as an endocyst would be possible. But after much consideration, the above assignment seems to be justified. Of course the perfectly circular form of the valves is against an attempt to refer to it as an endocyst of some unknown *Chaetoceros.* However, attention should here be called to the similarity between *Hercotheca* and the endocyst of *Chaetoceros coronatum* Grunow (Nordsk. Nord. Exp., pl. 2, figs. 28–31.)

Type.—Cat. No. 43628, U.S.N.M.

Genus HYALODISCUS Ehrenberg

For the reasons for including this and *Podosira* Ehrenberg in one genus see my Diatoms of the Albatross Voyages (p. 240) and for giving the preference to this instead of to the older *Podosira* see discussion in the introductory part of this paper.

HYALODISCUS ANNULUS, new species

Plate 18, fig. 3

Valve slightly convex, the curvature small until near the rim; umbilicus large, heavily rugose, separated from the rest of the valve by a wide, hyaline and glistening, sutural ring; outside of this the valve rather coarsely marked with diagonal, curved crosslines—"watch-milling" pattern—uniform to the border or rim; the latter wide, with a single row of closely set, minute beads on the inner edge, the outer nearly hyaline, with faint crosshatching.

Diameter, 0.071; diameter of umbilicus, 0.023 mm.

Several unnamed figures of this occur, a good one in Janisch's Diatoms of the Gazelle Expedition (pl. 20, fig. 4).

Type.—Cat. No. 43629, U.S.N.M.

HYALODISCUS ARGUS (Grunow) Mann

(Journ. Roy. Micro. Soc., 1879, pl. 21, fig. 6.)

HYALODISCUS ASPERSUS, new species

Plate 17, figs. 3–5

Valve circular, the middle portion about one-half the diameter, very convex, progressively less so to the margin, where it is nearly flat; covered with fine, closely set beading in quincunx pattern, producing thereby a watch-milling effect, spattered with small irregular beads or blotches crowded about the middle part and flung radially outward, thus curiously imitating a spattered ink blot, scanty halfway to margin, there becoming more abundant; umbilical center very small and obscure; a strong narrow rim, finely crosslined and further marked with a single row of closely set rectangular beads.

Diameter 0.082; width of rim 0.0024 mm.

Type.—Cat. No. 43630, U.S.N.M.

HYALODISCUS CERVINUS Brightwell

(Quart. Journ. Micro. Sci., 1860, p. 95, pl. 5, fig. 9.)

This delicate diatom, which Ralfs (Pritchard, Inf., p. 831), O'Meara (Irish Diat., p. 262), and Rattray (Rev. Cosc., p. 145) have decided to be a *Coscinodiscus* has been carefully studied with numerous specimens from the Philippine Islands. It proves to be, as Brightwell thought, a *Hyalodiscus*. Its umbilicus is very small, in some cases almost obliterated, but in others it is quite evident. It is probable Brightwell found such specimens when he named it.

HYALODISCUS HIRTUS, new species

Plate 18, fig. 4

Valve circular, moderately and evenly convex; umbilicus large, heavily rugose, separated from the rest of the valve by a heavy irregularly serrate suture; between this and the rim the valve is marked with closely set rows of beading, generally radial, but somewhat modified to form broad and imperfect fascicles, which are marked off by indistinct intervening rays; midway between the umbilical center and the rim is an indefinite ring of short and blunt spines, superimposed upon the beading; rim very stout, finely cross-marked by rows of indistinct beads, the outermost beads larger and forming a marginal ring.

Diameter, 0.077; diameter of umbilicus, 0.026; width of rim, 0.005; lines of beading, 13.5 in 0.01 mm. midway.

There is a faint resemblance between this and *Stephanopyxis robusta* Leuduger-Fortmorel (Diat. Malaisie, p. 46, pl. 4, fig. 6).

Type.—Cat. No. 43631, U.S.N.M.

HYALODISCUS LAEVIS Ehrenberg

(Ehrenberg, Mikrogeologie, pl. 33, sec. 15, fig. 17.)

The umbilicus of this species is always much larger than that of Bailey's *H. subtilis* and its marking, coarser; but even so, the two are rather too close.

HYALODISCUS PROPEPLANUS, new species

Plate 18, fig. 5

Valve practically flat, except for a slight co vexity near the rim; umbilicus large, with strong rugose or vermiform marking, separated from the rest of the valve by a narrow irregular suture; outside of this the valve covered with closely set, perfectly radial rows of minute beads, becoming barely smaller near to the rim; its surface further marked with frequent dashes or lines, very evenly distributed and radial; rim relatively narrow, marked, with a single row of obscure beads.

Diameter, 0.170; diameter of umbilicus, 0.064 mm.

There is an evident resemblance between this delicate species and the coarser and much more convex *H. maximus* Petit, which may be considered as a variety of *H. radiatus* (O'Meara) Grunow, especially as it is figured by Peragallo, Diatomees, France, plate 119bis, figure 6.

Type.—Cat. No. 43632, U.S.N.M.

HYALODISCUS STELLIGER Bailey

(Van Heurck, Synopsis, pl. 84, figs. 1–2; Schmidt, Atlas, pl. 139 fig. 7.)

An excellent figure of this is also given by Smith (Brit. Diat., pl. 49, fig. 328) under the name *Podosira maculata* W. Smith.

HYALODISCUS SUBTILIS Bailey

(Pritchard, Inf., p. 815, pl. 5, fig. 60; Janisch, Diat., Hond., pl. 1, fig. 16.)

Genus HYDROSILICON Brun

HYDROSILICON RIMOSA (O'Meara) Brun

(Micro. Journ., 1871, pl. 3, fig. 1; see also Brun, Espec. Nouv., pl. 21, fig. 8.)

Genus ISTHMIA Agardh

ISTHMIA MINIMA Bailey and Harvey

(H. L. Smith, Type No. 205; Schmidt, Atlas, pl. 136, figs. 4, 8, 9; pl. 145, figs. 1, 9; Walker and Chase, New and Rare Diat., p. 5, pl. 5, fig. 9; Grunow, Diat., Hond., p. 182, pl. 196, figs. 1. *a–d*; and the rather crude original figure in Wilkes Exped., vol. 17, pl. 9, fig. 11.)

This form is well illustrated in Schmidt's Atlas, plate 136, figure 8, which he suggests may be a new species. It proves to be only a rather wide variety of the above. Specimens on the H. L. Smith Type slide No. 205, which are uniformly accepted as correctly named *I. minima*, agree perfectly. It is quite probable that *I. lindigiana* Grunow (Diat. Honduras, Monthly Micro. Journ., 1877, pl. 196, fig. 1), and *I. capensis* Grunow (Monthly Micro. Journ., p. 182) are merely varieties of the same. The latter, Kitton in a footnote suggests, may be the above, and it is certain that the figure in Schmidt's Atlas, plates 136 and 145, are not specifically separate, an opinion held by Witt and recorded in plate 145, figure 5. H. L. Smith writes in connection with his above No. 205 that *I. minima* Bailey and Harvey equals *I. lindigiana* Grunow. Grunow justifies his two specific names by saying that *I. capensis* is distinguishable from *I. lindigiana* solely on the grounds of the presence of certain dim club-shaped bodies enclosed within the frustules of the latter. That these are no essential part of the diatom is unquestionable and they may be dropped out of consideration. The only difficulty in the foregoing is that Grunow's figure of *I. lindigiana* represent the coarser markings to be truly rectangular and filled with closely set beading and the markings of the girdle to be elongated bars; whereas in *I. minima* and in my own specimen the markings are round or oval blotches with fine but evident beading around their margins only, and the markings of the girdle are not bars but at most oval, and are often rounded into disks set in quincunx order.

It is interesting to note that Professor Bailey mentions this diatom as occurring in the "Sooloo Sea" where I also have found it, as well as in other localities in the Philippine Islands.

Long diameter of valve, 0.107–0.135; width of frustule, 0.152–0.180 mm.

Genus LEUDUGERIA Tempere

LEUDUGERIA JANISCHII Grunow

(Van Heurck, Treat., p. 539, fig. 287; Van Heurck, Synopsis, pl. 127, figs. 1–4, misnamed.)

This coarse but handsome species is common in the Philippine Islands. Its early assignment to *Euodia-Hemidiscus*, rested merely on its obscure resemblance in outline to members of that genus, in which respect it more closely agrees with *Epithemia*. In fact, *Epithemia? monilifera* Petit, (Diat. Camp. Isl., p. 241, pl. 14, fig. 10) is so close to this that I suspect the two are the same; in which case the name should become *Leudugeria monilifera* (Petit) Mann.

Genus LICMOPHORA Agardh

LICMOPHORA DEBYI (Leuduger-Fortmorel) Mann

Plate 18, fig. 6

(Leuduger-Fortmorel, Diat., Malaisie, pl. 5, fig. 3.)

This remarkably shaped diatom is placed in the genus *Pseudo-Synedra* by Leuduger-Fortmorel, an assignment that must be rejected. The looseness of that author's classification is seen by comparing his gure of this species with figure 2 of the same plate, also assigned to *Pseudo-Synedra*. Not only is its *Licmophora* character evident from a study of the valve view, but an entire frustule enabled me to fix its true position beyond question. In fact, it differs from certain specimens of *L. ehrenbergii* Kützing merely in having its anterior end lengthened into a club-shaped extension, like the neck of a bottle. (Compare with the figures of *L. ehrenbergii* Peragallo, Dia. France, pl. 85, figs. 4–5.)

LICMOPHORA OVATA (W. Smith) Grunow

(Van Heurck, Synopsis, pl. 47, figs. 12–13; Smith, Brit. Diat., pl. 24, fig. 226.)

Genus MASTOGLOIA Thwaites

Here are included most of those *Cocconeis*-like forms with chambered bands along the sides of each valve, but under and disconnected from them, and with a central rhaphe on each valve, generally classified under the generic name, *Orthoneis*. A careful study of both the valves and these peculiar chambered annuli makes the identity of the two certain. Cleve has adopted this view in his Naviculoid Diatoms, volume 2, page 142.

MASTOGLOIA ACHNANTHIOIDES new species

Plate 18, fig. 7

Valve fusiform with acute apices, slightly narrowed at the middle, crossed by fine and very close beaded lines, somewhat flaring on either side of the central nodule, otherwise diagonally inclined from the center, none transverse; marginal chambers small, uniform, extending almost to the apices; median longitudinal area very narrow, so that the beading extends almost to the tortuous rhaphe.

Length 0.051–0.084; width 0.021–0.022; 12 to 13 lines in 0.01 mm.

Its nearest relative is *M. constricta* Cleve as given in Le Diatomiste, page 159, plate 23, fig. 5; also in Cleve's Naviculoid Diatoms, volume 2, page 154; but that is a narrower and more angular form with finer markings,21 lines in 0.01 mm., which are strictly transverse and with their beading so spaced as to produce wavy longitudinal lines. It also has some affinity with *M. fallax* Cleve (Nav. Diat., vol. 2, p. 153, pl. 2, fig. 16) from Java, which differs from it in form and in the oval character and arrangement of the beading.

Type.—Cat. No. 43633, U.S.N.M.

MASTOGLOIA CAPAX, new species

Plate 19, fig. 1

Valve broadly fusiform, apices not produced, marked with finely beaded, closely set lines practically transverse, but slightly diagonal toward the apices; median area very narrow; a small stauroslike hyaline expansion on either side of the central nodule, made by the withdrawal of the beaded lines; rhaphe slightly tortuous, delicate; central and terminal nodules minute; chambers next to the margin small and uniform in size, longer than wide, rounded on inner side, the rows reaching to the apices.

Length 0.087–0.101; width 0.042; 15–16 lines in 0.01 mm.

It is nearest to the doubtfully named figure of *M. affirmata* Leudger-Fortmorel in Schmidt's Atlas, plate 188, figure 31, which however has coarser markings, no stauros and straight rhaphe. It may be the same as the unnamed figure from Japan in Schmidt's Atlas, plate 204, figure 14, as Cleve's suggestion there recorded, that it may belong to *M. angulata* Lewis, is not acceptable. In case the marginal chambers of Schmidt's Atlas, plate 187, figure 41, also unnamed, are the same as the above, it could be included here as a somewhat attenuate variety.

Type.—Cat. No. 43634, U.S.N.M.

MASTOGLOIA CEBUENSIS, new name

Plate 19, fig. 2

This is well illustrated in Cleve's Naviculoid Diatoms (vol. 2, p. 159, pl. 11, fig. 26), but misnamed *M. lemniscata* Leuduger-Fortmorel. I have compared it with serveral specimens of the latter, which is fairly abundant in the Philippine Islands, and unless we are to admit here variations wide enough to obliterate many of the accepted species of this genus, including the distinctions between *M. lemniscata* and *M. leudugeri* Cleve and Grove, this form can not be referred to *lemniscata;* its general shape, its convexly bowed longitudinal ridges, its tortuous rhaphe, etc., being quite distinct. Nor can it include *M. decora* Leuduger-Fortmorel, as Cleve suggest. I have therefore put Cleve's form with my own into a separate species. (See *M. lemniscata* Leuduger-Fortmorel, Diat., Ceylan, p. 35, pl. 3, fig. 29.)

MASTOGLOIA COCCONEIFORMIS Grunow

(Schmidt, Atlas, pl. 188, fig. 43; Cleve, Nav. Diat., vol. 2, pl. 2, fig. 20.)

MASTOGLOIA CRUCIATA (Leuduger-Fortmorel) A. Schmidt

(Schmidt, Atlas, pl. 187, fig. 50; Leuduger-Fortmorel, Diat., Ceylan, pl. 2, fig. 19.)

MASTOGLOIA EGREGIA A. Schmidt

(Schmidt, Atlas, pl. 186, fig. 16.)

MASTOGLOIA ELEGANS Lewis

(Lewis, White Mt. Diat., pl. 2, fig. 16; Schmidt, Atlas, pl. 186, fig. 19; H. L. Smith, Types, No. 212.)

The faint longitudinal lines near to and parallel with the rhaphe, which Schmidt (Atlas, pl. 186, fig. 19) seems to think are typical, are not so. Specimens both with and without them were found in the Philippine Islands, and those in H. L. Smith's types, made from the original material, are without them.

MASTOGLOIA FUSIFORMIS, new species

Plate 19, fig. 3

Valve fusiform with very acute apices; marked with beaded lines, strictly transverse until near the apices, there slightly oblique outward, reaching almost to the rhaphe, so that a barely perceptible hyaline space remains on either side of it; the beads elongated and so spaced in the alternate lines as to produce a brick-wall pattern; parallel to the rhaphe on either side run double lines formed by slightly enlarged beads, the outer of the parallel lines slightly shorter than the inner, and both flaring at the ends near to the center of the valve; the chambered loculi along the sides of the valve are unusually narrow and relatively long and extend to the apices.

Length 0.105; width 0.040; lines 10.3 in 0.01 mm.; loculi 0.0045 by 0.0012 mm.

This is possibly the same as the unnamed figure in Schmidt's Atlas, plate 187, figure 36, from Cebu. Rare, in only one dredging.

Type.—Cat. No. 43635, U.S.N.M.

MASTOGLOIA GRUENDLERI A. Schmidt

(Schmidt, Atlas, pl. 188, fig. 26.)

This is another species found only at Campeche Bay and the Philippines Islands.

MASTOGLOIA IMITATRIX, new species

Plate 19, fig. 4

Valve convex, narrowly oval in outline, slowly tapering to the blunt rounded apices; the rhaphe is strongly oblique, that is to say, it is diagonal to the long axis, but runs straight until near the apices where its two ends curve strongly to opposite sides; adjacent to either side of the rhaphe is a parallel line; the central nodule is slightly dilated but is not surrounded by a hyaline central area; the valve markings are delicate, closely set lines obscurely crossed-marked, reaching the parallel lines bordering the rhaphe, transverse until near the ends and there slightly oblique; the lateral rows of chambers lie next to the rim, are all of the same size, the terminal ones being tapered and do not reach the apices; in side (girdle) view there is seen to be a slight depression of the valve across its middle; the ends are bluntly rounded; the girdle is hyaline and is not oblique.

Length 0.071; width 0.047; 15 lines in 0.01 mm., 3 chambers in 0.01 mm.

The striking imitation by this unmistakable *Mastogloia* of *Scoliopleura tumida* Brébisson raises interesting questions of relationship, especially when taken in connection with the fact that W. Smith called the latter *Navicula jenneri* and Cleve restores it to that genus under the name *N. tumida* (Brébisson) Cleve, and also when we remember that many examples of *Mastogloia* differ from *Navicula* only in the presence of the chambered compartments along both sides of the valve. For we are herein led to ask if these internal rows of chambers are anything more than persistent craticular structures, homologous with the craticular plates sometimes observed in certain *Naviculae,* such as *N. cuspidata* Kützing. *N. ambigua* Ehrenberg, etc. It was my good (or bad) fortune to disturb the specimen here illustrated after it had been mounted in face view and its compartments had been studied and measured; so that it turned over into side (girdle) view and thereby enabled me to see that the lateral rows of chambers occupy their usual position within each valve. It is true this species is different from *Scoliopleura tumida,* in having more truly transverse and somewhat finer lines of sculpture, in the absence of any hyaline oval area about the central nodule or alongside of the rhaphe, and in the presence of a definite line bordering this rhaphe on either side and continuous across the middle of the valve. But such bordering lines are to be seen in other species of *Scoliopleura*, as *S. peisonis* Grunow and *S. schneideri* (Grunow) Cleve. It will be well for diatomists to take note of any close similarities between members of the genus *Navicula* and the genus *Mastogloia*.

Type.—Cat. No. 43636, U.S.N.M.

MASTOGLOIA JAVANICA Cleve

(Cleve, Nav. Diat., vol. 2, p. 159, pl. 2, figs. 22–23; Schmidt, Atlas, pl. 188, fig. 38.)

Cleve's species agrees poorly with the above figure in Schmidt's Atlas, although he seems to accept it.

MASTOGLOIA JELINECKIANA Grunow

(Grunow, Reise F. Novara, p. 99, pl. 1A, fig. 11; Schmidt, Atlas, pl. 187, figs. 39, 49; H. L. Smith, Types, No. 213.)

MASTOGLOIA LEMNISCATA Leuduger-Fortmorel

(Leuduger-Fortmorel, Diat., Ceyl., pl. 3, fig. 29; Schmidt, Atlas, pl. 186, fig. 15.)

MASTOGLOIA LEUDUGERI Cleve and Grove

(Schmidt, Atlas, pl. 186, fig. 13.)

MASTOGLOIA LINEATA Cleve and Grove

(Le Diat., p. 59, pl. 9, fig. 11.)

This species is very close to *M. exarata* Cleve (Nav. Diat., vol. 2, p. 156, pl. 2, fig. 35) also to *M. albifrons* Brun, according to Schmidt in his Atlas, plate 187, figure 38.

MASTOGLOIA OCULIFORMIS Brun

(Schmidt, Atlas, pl. 187, fig. 39.)

Probably only a small variety of *M. jelineckiana* Grunow.

MASTOGLOIA OVATA Grunow

Plate 19, fig. 5

(Cleve and Grunow, Arct. Diat., p. 17, pl. 1, fig. 2.)

MASTOGLOIA OVUM-PASCHALE (A. Schmidt) Mann

(Schmidt, Atlas, pl. 8, fig. 56; misnamed; Peragallo, Diat., France, pl. 5, fig. 13, misnamed.)

This remarkably individual diatom was placed in *Navicula* by Schmidt in 1885, probably because he did not have a complete frustule and thus missed seeing the marginal rows of chambers by which alone *Mastogloia* can be safely distinguished from *Navicula*. Peragallo later called it *Orthosira aspera* in the above-cited reference. The original specimen came from Yokohama.

MASTOGLOIA PULCHELLA Cleve

(Cleve, Nav. Diat., vol. 2, p. 157, pl. 2, figs. 27–29.)

MASTOGLOIA QUINQUECOSTATA Grunow

Plate 19, figs. 6, 7

This is Grunow's species as figured and described in his Neue and Ungenügend Bekannte Algen, page 578, plate 5, figure 8, and undoubtedly includes figures 10 and 17 and probably 18 in Schmidt's Atlas, plate 186. Here too may be included *M. sinuata* A. Schmidt (Atlas, pl. 186, fig. 11) and possibly the unnamed plate 186, figure 12; because Brun's suggestion of considering the latter to represent *M. elongata* Leuduger-Fortmorel is a very doubtful one. Leuduger-Fortmorel expressly indicates in figure and description (Diat. Ceylan, p. 35, pl. 3, fig. 31) that his specimens are destitute of beading set in transverse lines, a character hardly to be overlooked in this figure, where it is fully as evident as in other species figured on the same plate of Schmidt's Atlas. But Cleve, who favors this condensation in his Naviculoid Diatoms (vol. 2, p. 161), seems to have been obsessed by the idea that all *Mastogloias* having longitudinal lines on both sides of the rhaphe must be grouped in *M. quinquecostata* Grunow, for he assembles under that name species the marginal chambers, general outlines, and even the number and straightness of the longitudinal lines of which are wholly unlike each other. Thus he includes *Navicula egeria* Pantocsek (Hung. Diat., vol. 3, pl. 42, fig. 578), *Mastogloia obscura* Leuduger-Fortmorel (Diat., Ceylan, pl. 3, fig. 33), *M. grunowii* A. Schmidt (Atlas, pl. 186, figs. 1–7), *M. kerguelensis* Castracane (Chall. Exp., pl. 15, fig. 11) *M. concinna* A. Schmidt (Atlas, pl. 186, fig. 9), none of which properly belong here, and hints that *M. mauritiana* Brun (Schmidt, Atlas, pl. 186, fig. 28) and *M. sansibarica* A. Schmidt (Atlas, pl. 187, fig. 44) may also prove to be this species. Doubtless *M. quinquecostata* Grunow shows variations; but if we make it as variable as the above, consistency demands that *M. lemniscata* Leuduger-Fortmorel, as figured by Cleve in the same work and a lot of other well-known species, should be added to the same heterogeneous mass. It need hardly be said that Schmidt's objection to the name *quinquecostata*, as not truly descriptive, is a worthless argument. His *M. grunowii* (Schmidt, Atlas, pl. 186, figs. 1–7) is however truly distinct from *M. quinquecostata*, as he and Brun assert. The markings, and especially the marginal chambers, are strikingly different. My specimens measure; Length, 0.070–0.099; width, 0.023–0.028; lines, 14 in 0.01 mm.

MASTOGLOIA RHOMBUS (Petit) Cleve

(Schmidt, Atlas, pl. 187, figs. 33–35; Le Diat., vol. 1, p. 58, pl. 9, fig. 12. See Petit, Diat., Camp. Isl., p. 242, pl. 14, fig. 12.)

This is another species found both at Campeche Bay and Philippine Islands.

MASTOGLOIA SANSIBARICA A. Schmidt

(Schmidt, Atlas, pl. 187, fig. 44.)

MASTOGLOIA SERIATA Cleve and Grove

(Le Diat., vol. 1, p. 66, pl. 10, fig. 6.)

MASTOGLOIA SINUATA A. Schmidt

(Schmidt, Atlas, pl. 186, fig. 11.)

MASTOGLOIA SPLENDIDA (Gregory) Cleve

(Van Heurck, Synopsis, pl. 28, figs. 1–2.)

Cleve has rightly united *Orthoneis* with *Mastogloia.*

MASTOGLOIA SQUAMOSA Brun

(Schmidt, Atlas, pl. 188, fig. 19.)

Cleve's attempt to unite this with *Navicula affirmata* Leuduger-Fortmorel (Diat., Ceylan, pl. 2, fig. 22) can not be approved.

Genus MELOSIRA Agardh

MELOSIRA CORONARIA Mann

(Mann, Diat., Alb. Voyages, p. 237, pl. 51, figs. 1–2.)

MELOSIRA DURA, new species

Plate 20, figs. 1, 2

Valve circular, very convex inside of the narrow flat rim; marked with fine watch-milling, over which are thickly scattered short, stout but sharp pointed spines, increasing slightly in size and abundance toward the margin; rim having a single row of beads.

Diameter 0.041–0.044 mm.

Spine-bearing and convex forms like the above are frequently referred to the genus *Stephanopyxis;* as for example the quite similar "*Stephanopyxis robusta*" Leuduger-Fortmorel (Diat. Malasie, p. 46, pl. 4, fig. 6). But it is questionable if any form with a distinct rim and radially arranged puncta can be referred to this genus, solely because they are convex and spiny. They stand much closer to the nearly related genus *Melosira,* many authentic species of which are more or less spiny, as for instance, *M. setosa* Greville (Schmidt, Atlas, pl. 182, figs. 42–46), *M. hispida* Janisch (Schmidt, Atlas, pl. 182, figs. 54–55). For this and other reasons I think that the union of the members of the genus *Trochosira* should be grouped with that subgenus of Melosira, "*Skeletonema,*" rather than united with *Stephanopyxis,* as is done by Van Heurck. It is true that all these forms are closely similar in their chain-forming method of growth and their convex spiny valves. But if the chief purpose of taxonomy is to classify and render available the objects of nature, rather than to show generic relationships—the only view present possible with the diatoms—the arrangement above indicated seems to me the best. It should be added that some undoubted members of *Stephanopyxis* are destitute of spines, as for instance, *Stephanopyxis turris*, var. *arctica* forma *inermis* Grunow (F. Jos. Land, pl. 5, fig. 18). The superficially similar *S. robusta* Leuduger-Fortmorel above referred to has a large hyaline central area (*Hyalodiscus?*) outside of which are radiating lines of fine beading. It is also a much larger diatom and resembles more closely my *Hyalodiscus hirtus*, new species.

Type.—Cat. No. 43637, U.S.N.M.

MELOSIRA GOWENII A. Schmidt

Plate 20, figs. 3–4

(Schmidt, Atlas, pl. 176, figs. 4–6; name on pl. 180.)

This appears to be a marine phase of *M. undulata* Kützing. It may, however, be accorded specific rank, as the Philippine Islands specimens are clearly the same as the type form found at San Francisco, Calif. My specimen shows the umbilicuslike center common in *M. undulata.* It is rather close to what Schmidt in his Atlas, plate 180, figure 22, calls *M. bisereata* Ehrenberg, which, however, is not the same as that diatom as shown in Ehrenberg's Mikrogeologie, plate 33, section 12, figure 18. In the girdle illustration here given note the difference in contour of the two adjacent valves.

Diameter of valve, 0.084; depth of frustule, 0.060 mm.

MELOSIRA INCOMPTA, new species

Plate 20, fig. 5

Frustule an elongated cylinder terminating at each end in a truncated cone, the whole exactly resembling a gelatine capsule; a shallow groove around each valve where it joins the narrow girdle; both valves, but not the girdle, sparingly and irregularly spotted with small beads becoming somewhat denser toward the ends.

Length of frustule, 0.073; width of frustule, 0.017 mm.

This apparently unfinished diatom is not at all uncommon in Philippine Islands dredgings.

Type.—Cat. No. 43638, U.S.N.M.

MELOSIRA MADAGASCARENSIS A. Schmidt

(Schmidt, Atlas, pl. 181, fig. 79.)

This anomalous diatom is placed here for convenience, although its being a *Melosira* is very doubtful. It is abundant in Philippine Islands material and ranges from small tubular frustules with rounded apices (valves) to comparatively huge specimens, massively built, with frustules little if at all longer than broad. Although the coarse, irregular blotches which constitute the marking of the vertical sides (flanges) and convex tops of the valves are separated into a central and outer area by a crude hyaline ring about midway between the center and edge of each valve, there is no central scar or other indication that the frustules grow attached in filaments, nor have I ever found them so united. If they have that habit of growth, the fact would go far toward fixing the position of this diatom in *Melosira* As it is, it looks very unlike any member of that genus but does not seem to fit into any other assignment.

MELOSIRA MEDITERRANEANA Grunow

(Van Heurck, Synopsis, pl. 91, figs. 3, 5.)

This also is a doubtful member of this genus. De Toni (Syl. Alg., p. 1157) refers it to *Skeletonema*, to which it has about equal affinities

Genus NAVICULA Bory

NAVICULA ABRUPTA Gregory, var.?

(Schmidt, Atlas, pl. 2, fig. 34, misnamed, and compare pl. 3, fig. 21.)

NAVICULA ACROSPHAERIA (Brébisson) Kützing

(Schmidt, Atlas, pl. 43, fig. 16.)

The union with *N. tabellaria* Kützing in De Toni's Sylloge Algarum, page 26, is unwarranted. Its presence here is as a fresh-water interpolation in some of the Philippine Islands bays.

NAVICULA AESTIVA Donkin

(Donkin, Diat., Northumb., p. 32, pl. 3, fig. 18; Donkin, Brit. Diat., pl. 1, fig. 3.)

NAVICULA ANGULOSA Gregory

(Gregory, Glenshira Diat., pl. 5, fig. 8; Donkin, Brit. Diat., pl. 4, fig. 4.)

Van Heurck and De Toni put this as a variety of *N. palpebralis* Brèbisson, an admissible assignment.

NAVICULA ANTILLARUM (Cleve) Mann

(Cleve, W. I. Diat., p. 8, pl. 2, fig. 11.)

Cleve suggests that this diatom may belong to *Navicula*, but prefers his new genus, *Alloioneis*. As with Van Heurck, Schmidt, and others, I do not recognize the latter as anything but a subgeneric division of Navicula, the alternative of Cleve is here adopted. I see nothing but the inadequate fact of a lightly diagonal rhaphe to sustain Pelletan's idea of this belonging to *Scoliopleura*, a view followed by De Toni (Syl. Alg., p. 265).

NAVICULA APPROXIMATA Greville

(Edin. N. Phil. Journ., vol. 10, pl. 4, fig. 10; Greville, Cal. Guano, pl. 4, fig. 4.)

Grunow's var. *substauroneiformis* in Schmidt's Atlas, plate 2, figures 20–21, was also found and is another case of forms peculiar to Campeche Bay and the Philippine Islands.

NAVICULA ASPERA Ehrenberg

(Ehrenberg, Mikrogeologie, pl. 35A, sec. 20, fig. 5; Donkin, Brit. Diat., pl. 10, fig. 1; Schmidt, Atlas, pl. 48, figs. 2–6.)

Many varieties of this truly cosmopolitan marine diatom occur in the gatherings examined.

NAVICULA BARBITOS A. Schmidt

(Schmidt, Atlas, pl. 129, fig. 5.)

NAVICULA BEYRICHIANA A. Schmidt

(Schmidt, Atlas, pl. 69, figs. 16–17.)

Fricke's Index to Schmidt's Atlas incorrectly unites this with *N. gemmatula* Grunow (see the latter in Schmidt, Atlas, pl. 13, figs. 20–21). It has far more affinity with *N. crabro* (Ehrenberg) Kützing.

NAVICULA BICLAVATA Cleve and Grove

(Le Diat., vol. 1, p. 66, pl. 10, fig. 7.)

Resembles *N. clavigera* Cleve in Naviculoid Diatoms, volume 1 page 56, plate 1, figure 3.

NAVICULA BIFORMIS (Grunow) Mann

Plate 20, figs. 6, 7

(Grunow, Neu Ung. Diat., pl. 13, fig. 7; Peragallo, Diat., France, pl. 7, fig. 5; Greville, So. Pac. Diat., pl. 4, fig. 13.)

There is no more reason for making a new genus, *Mastoneis*, for this diatom because of its double markings, than for the same reason to put into new genera *N. beyrichiana* A. Schmidt; or those double-marked *Coscinodisci*: *C. asteromphalus* Ehrenberg, *C. convexus* A. Schmidt, and *C. biangulatus* A. Schmidt, the elaborate beading within the network of which is lacking in most species of *Coscinodiscus*. Both Grunow and Greville assign this *Navicula* to *Stauroneis*, because of its obscure stauros. As Cleve points out, it also has a sort of family resemblance to *Mastogloia*.

NAVICULA BIGEMMATA, new species

Plate 21, fig. 1

Valve fusiform, with acute apices, covered with radial (not transverse) rows of fine beading, the beads irregularly spaced, so that the valve presents a wavy, shagreenlike appearance; a distinct line running on each side of the rhaphe, in general midway between it and the margin, but at the center curved rapidly inward toward the central nodule and having at this inner point a distinct bead, one therefore on each side of the central area; the portion of the valve included within these hyaline lines is slightly more elevated than the outer portions, as in *Navicula carinifera* Grunow; a hyaline band crosses the center between the two beads; the rhaphe is straight.

Length, 0.113 to 0.143; width, 0.037 to 0.038; 8.2 lines in 0.01 mm.

This beautiful form has affinities with several species, like *Navicula* (*Pseudo-Amphiprora*) *stauroptera* Bailey, called *N. arctica* by Cleve in his Arctic Diatoms, plate 3, figure 13; but especially with *N. jugata* Cleve (New and Little-Known Diat., p. 13, pl. 3, fig. 39). It differs in its more prismatic outline, its very acute apices, its radial and irregular beading, and in the sharp central incurve of its hyaline lines, with the two strong beads at the central area. As Cleve (Nav. Diat., vol. 1, p. 71) unites his species with *N. pensacola*, a form impossible to include with mine, the dissimilarity of this and *N. jugata* is emphasized. Cleve's species is from the Gallapagos Islands and its variety from Florida.

I can not see the advantage of the new genus *Pseudo-Amphiprora*, created by Cleve to accommodate his *N. jugata* and some similar species, which would include this one also. The chief distinction, the elevated central portion extending the length of the valve, is not at all infrequent in *Navicula*, for example, *N. carinifera* Grunow, and the side lines and stauroslike central area are nothing more than a union of the frequent *N. lyra* style of marking with a carinate central elevation. That it indicates a well-marked subgeneric division is admitted, but to separate it from *Navicula* is to create confusion for diatom students.

Type.—Cat. No. 43639, U.S.N.M.

NAVICULA BLEISCHIANA Janisch and Rabenhorst

(Janisch and Rabenhorst, Diat., Hond., p. 9, pl. 2, fig. 10; Schmidt, Atlas, pl. 50, figs. 22–25.)

Written *N. bleischii* on the plate and is so given by Schmidt.

NAVICULA BOMBOIDES A. Schmidt

(Schmidt, Nordsee Diat., pl. 1, fig. 2; Schmidt, Atlas, pl. 13, figs. 36–40.)

NAVICULA BRANCHIATA, new species

Plate 21, fig. 2

Valve figure eight (8) in shape, that is, round-panduriform; cross-barred with smooth and wavy costae, slightly connivant near the middle, but progressively curved from the middle as they approach the two ends, where they attain an almost longitudinal direction; wholly unbeaded except for a single bead in the slightly enlarged marginal end of each costa; median area on either side of rhaphe broad and bordered with a single row of imperfect beads or blotches corresponding in number and position to the adjacent rows of costae; widest transverse diameter of each half of the valve exactly midway between the center and the end.

Length, 0.093; width, 0.028; costae, 6.2 in 0.01 mm.

This diatom is nearest to the original type form of *N. pandura* Brébisson, as figured in his Diatomées de Cherbourg, plate 1, figure 4, and in Schmidt's Atlas, plate 11, figure 4; but its peculiarly rounded contour, wavy costal bars, etc., make its specific distinctness much more evident to the eye than any verbal description could indicate.

Type.—Cat. No. 43640. U.S.N.M.

NAVICULA BRASILIENSIS Grunow

(Schmidt, Atlas, pl. 6, figs. 19–21; pl. 23, fig. 25,; pl. 31, fig. 33.)

NAVICULA BULLATA Norman

(Micro. Journ., 1861, pl. 2, fig. 7; Schmidt, Atlas, pl. 3, figs. 8–9.)

Its value as a separate species solely because of the blotches in the lyrate hyaline area is very questionable, these blotches being variable in character and number and not infrequent in other species.

NAVICULA CAECA, new species

Plate 21, fig. 3

Valve long, narrow, constricted at the middle, gently curving outward to slightly less than one-half the distance to the apices, then narrowing to the rounded apices; crossed by very fine, closely set obscurely moniliform lines, which are strictly transverse except close to the apices, where they are barely diagonal; median hyaline area hardly perceptible, except for a slight oval unsymmetrical space at the center; rhaphe strong, hooked at the apices, very slightly bent to one side at the center.

Length, 0.0732; width, 0.0162; lines, 22 in 0.01 mm.

This is essentially the unnamed species in Schmidt's Atlas, plate 50, figure 34, which came from King Mill Island. My specimen is somewhat narrower and the bend of the rhaphe ends at the center is less pronounced. The gentle curves of this specimen give to it a very graceful outline. Rare.

Type.—Cat. No. 43641; U.S.N.M.

NAVICULA CALIFORNICA Greville

(Greville, Cal. Guano, p. 29, pl. 4, fig. 5; Schmidt, Atlas, pl. 3, figs. 6, 15–16, 19.)

Although all the above may be considered to be varieties of *N. hennedyi* the type form is far from close. Variety *campechiana* is another diatom common both to Campeche Bay and the Philippine Islands.

NAVICULA CAMPYLODISCUS Grunow

(Schmidt, Atlas, pl. 8 figs. 9–10, 12; pl. 70, figs. 64, 65.)

This species is another form common to both Campeche Bay and the Philippine Islands.

NAVICULA CARIBAEA Cleve

(Schmidt. Atlas. pl. 2, fig. 17; pl. 6, figs. 10–12; pl. 70, fig. 48.)

NAVICULA CARINIFERA Grunow

(Schmdit, Atlas, pl. 2, figs. 1–2; pl. 70, fig. 42.)

This is another species common to both Campeche Bay and the Philippine Islands. No other localities are recorded except Jamaica Island by Kitton.

NAVICULA CASTRACANEI Grunow

(Cleve, New and Little Known Diat., p. 12, pl. 3, fig. 33.)

NAVICULA CHERSONENSIS Grunow

(Schmidt, Atlas, pl. 69, fig. 21.)

Another species common to both Campeche Bay and the Philippine Islands. The curved vertical lines, formed by separation of the beading, should distinguish it from *N. splendida* Gregory.

NAVICULA CIRCUMSECTA Grunow

(Cleve and Grunow, Arct. Diat., p. 42; Schmidt, Atlas, pl. 3, figs. 26–27, misnamed.)

This Schmidt wrongly identifies as a variety of *N. polysticta* Greville, quite a different thing, as is seen by comparing with that diatom in Greville's paper on Naviculae in California Guano, plate 4, figure 2· Fricke's index attempts to correct this by making it a variety of *N. hennedyi* W. Smith, which it certainly is not. It is near to the questionable variety of *N. californica* shown in Schmidt's Atlas, plate 3, figure 6; but Grunow's new specific name for it is the best arrangement.

NAVICULA CLAVATA Gregory

(Micro. Journ., 1856, pl. 5, fig. 17; Donkin, Brit. Diat., pl. 2, fig. 8; Schmidt, Atlas, pl. 70, fig. 50.)

The reducing of this well-marked diatom to a variety of *N. hennedyi*, suggested by Van Heurck and carried into effect by De Toni (Syl. Alg., p. 104) has nothing to commend it.

NAVICULA CLEPSYDRA Donkin

(Donkin, Brit. Diat., p. 63, pl. 10, fig. 2; Schmidt, Atlas, pl. 48, figs. 38–39; H. L. Smith, Types, No. 257.)

NAVICULA COARCTATA Ehrenberg

(Ber., 1842, p. 265; Schmidt, Atlas, pl. 11, figs. 30–32; pl. 69, fig. 11.)

This species is well illustrated by Schmidt; but it is doubtful if it can be proven to be what Ehrenberg so names. It is another one of the species peculiar to both Campeche Bay and the Philippine, Islands.

NAVICULA CONSORS A. Schmidt

(Schmidt, Atlas, pl. 48, figs. 24–27.)

NAVICULA CORPULENTA, new species

Plate 21, fig. 4

Valve unusually broad at the center, rapidly narrowed to the rounded ends; marked with a broad band of fine beaded lines, radially arranged along each side, narrowing and disappearing at the margins at the point where the broad central part passes into the clavate ends; these ends marked by similar beaded lines on either side of the rhaphe, which gradually narrow as they approach the center of the valve, and stop with the ends of the rhaphe at the central nodule; the rest of the valve is hyaline, rarely rugose, thus forming an oval median area within the marginal bands of beading and divided by the clavate beading bordering the rhaphe.

Length, 0.055–0.096; width, 0.038–0.056; lines, 18 in 0.01 mm.

This minute and constant diatom is plainly of the *N. clavata* group, but too widely divergent from it to be specifically identical.

It is very abundant in the Philippine Islands.

Type.—Cat. No. 43642, U.S.N.M.

NAVICULA CRABRO (Ehrenberg) Kützing

(Donkin, Brit. Diat., pl. 7, fig. 1; Schmidt, Atlas, pl. 69, fig. 1; Nordsee Diat., pl. 1, figs. 5–6; Ehrenberg, Mikrogeologie, pl. 19, figs. 29*a–c*.)

It is probable this variable and widely distributed diatom will always present difficulties in defining its specific boundaries; for it represents a group of the *Naviculae* that embraces more species than any other, perhaps more species than any other shape of diatom—that of a figure 8. But for that very reason a convenient and workable classification can be secured only by avoiding too sweeping condensations. Thus, the union here of such forms as *N. multicostata* Grunow, *N. pandura* Brébisson, etc., is not at all helpful. (See the latter in Diat. Cherbourg, pl. 1, fig. 4; Schmidt, Atlas, pl. 11, figs 1–2, 4, 8–9, and the former in Schmidt's Atlas, pl. 11 figs. 14–20.) On the other hand, the line of demarcation becomes difficult to see between *N. crabro* and *N. separabilis* A. Schmidt (pl. 11, figs. 28–29) despite its assertive name.

NAVICULA CUSPIDATA Kützing

(Smith, Brit. Diat., pl. 16, fig. 131; Donkin, Brit. Diat., pl. 6, fig. 6; Van Heurck, Synopsis, pl. 12, fig. 4.)

This fresh-water diatom probably came as detritus into the marine samples of Philippine flora.

NAVICULA CYCLOPS, new species

Plate 21, fig. 5

Valve broadly oval, ends not produced, beading of very fine lines which are radial near the margin but elsewhere broken up into a wavy pattern; arranged in four bands, two along the margin, about one-seventh the length of the transverse axis at the center, and becoming narrower toward the ends; two narrow bands midway between the sides and the middle, curving with the curve of the sides, except at the center of the valve, where they bend inward toward the central nodule; similar wavy beading on either side of the rhaphe, narrow at the apices, then broadening until near the center; rhaphe straight, with hooked apical ends, both bent toward the same side; a conspicuous ocellus set to one side of the central nodule.

Length, 0.090–0.132; width, 0.068–0.087; lines (margin), 11 in 0.01 mm.

The nearest affinity to this rather frequent Philippine diatom is *N. caliginosa* Cleve and Grove (Le Diat., vol. 1, pl. 10, fig. 9) from Macassar Strait.

Type.—Cat. No. 43643, U.S.N.M.

NAVICULA DELECTA, new species

Plate 24, figs. 5–7

Valve panduriform, considerably narrowed at the middle, apices slightly prolonged, acute; widest diameter of each half midway between middle and apex; markings of widely spaced, smooth or slightly granular costae, beginning with enlarged ends, a short distance inward from the margin and running nearly to the rhaphe, their length being in strict proportion to the width of the valve, so that the outer ends are everywhere equidistant from the margin; those near the middle slightly reflexed, absolutely transverse only at the widest diameter of the two halves and becoming more diagonal toward the apices; a row of short costae forming a border around the entire margin and extending downward over its curved edge; equal in number to and continuous with the longer costae, from which they are separated by a narrow hyaline space; rhaphe strong, straight, its middle ends well separated, its outer ends reaching the apices, with an evident median area on either side.

Length, 0.068–0.124; width, 0.028–0.035; lines, 4 in 0.01 mm.

There is an easily seen relationship between this ornate and graceful species and *N. bartholomei* Cleve (W. I. Diat., p. 6, pl. 1, fig. 5) which, however, is closer to *N. powellii* Lewis than to this form and is so classified in Fricke's index. *N. bartholomei* lacks the produced and acute apices of his species; its costae are broader, fewer, are all transverse, and "a row of small granules" replaces the marginal costae of *N. delecta.* Cleve's parallel between his species and varieties of *N. marginata* Lewis (*N. strangulata* Greville, etc.) is very fanciful. Nor, despite the similarity, should Fricke's classification of it as a variety of *N. powellii* be considered necessary. Frequent.

Type.—Cat. No. 43644, U.S.N.M.

NAVICULA DIDYMA Ehrenberg

(Smith, Brit. Diat., pl. 17, fig. 154; Van Heurck, Synopsis, pl. 9, figs. 5–6; H. L. Smith, Types, No. 265.)

NAVICULA DIFFUSA A. Schmidt

(Schmidt, Atlas, pl. 2, fig. 28.)

Another form in both Campeche Bay and the Philippine Islands.

NAVICULA DIPLOSTICTA Grunow

(Schmidt, Atlas, pl. 13, figs. 25–30.)

This is another diatom found at Campeche Bay and the Philippine Islands.

NAVICULA DURANDII Kitton

Plate 21, fig. 6

(Schmidt, Atlas, pl. 129, figs. 1–3.)

A blotched variety is named *N. bullata* Norman by Castracane in his Report of the Challenger Expedition, plate 28, figure 7. Another interesting variety is here figured.

NAVICULA ELONGATA Grunow

(Schmidt, Atlas, pl. 50, figs. 27–29; Nordsee Diat., pl. 2, fig. 42.)

It is most doubtful if this can be accepted as *N. elongata* of Ehrenberg in his Mikrogeologie, page 77, which seems to be a *nomen nudum.* It would be well to give this a new name.

NAVICULA ERYTHRAEA Grunow

(Grunow, Neu. Gek. Diat., pl. 3, fig. 17A; Schmidt, Atlas, pl. 6, fig. 22.)

Cleve, I think unnecessarily, makes this a variety of *N. cluthensis* Gregory (New and Little-Known Diat., p. 10.)

NAVICULA EUDOXIA A. Schmidt, variety

(Schmidt, Atlas, pl. 8, figs. 39–40, 45.)

Philippine specimens seem to belong to this species as figured above, especially with the unnamed figure 45, in the absence of any lateral enlargement of the rectangular central area. It is also what Schmidt formerly called *N. mediterranea* Grunow? in Nordsee Disatomaceen, plate 2, figure 10, which, though earlier (1874), can not be preferred, as it is preempted in Kützing's Bacillarien, plate 3, figure 17, (1844). Here also might be included two unnamed figures in Schmidt's Atlas, plate 8, figure 28 and plate 70, figure 68; possibly also what Peragallo misnames *N.* (*Diploneis*) *cynthia*, var. *intermedia* (Diat. Samoa, p. 5, pl. 1, fig. 16). Cleve (N. Diat., vol. 2, p. 82) has made this species a variety of *N. contigua* A. Schmidt, the type figure of which is in Schmidt, Atlas, plate 8, figure 43. Not only is this union not advantageous, but the preference for this latter name over

N. eudoxia is unwarranted. The idea advanced by Cleve (N. Diat., vol. 2, p. 82) of all these forms being corroded specimens of *N. gemmata* Greville is not worth consideration.

NAVICULA EXCAVATA Greville, wide variety

Plate 21, fig. 7

(Micro. Journ., 1866, pl. 12, fig. 15; Schmidt, Atlas, pl. 3, figs. 22–25.)

This is another diatom common to both Campeche Bay and the Philippine Islands.

NAVICULA EXIMIA Grunow

(Schmidt, Atlas, pl. 212, fig. 7.)

The type specimen came from the nearby Cebu.

NAVICULA EXPEDITA A. Schmidt

(Schmidt, Atlas, pl. 69, fig. 6.)

So far as I know, this species has not been found before except in the fossil material from Moron, Spain.

NAVICULA FORCIPATA Greville

(Micro. Journ., 1859, pl. 6, figs. 10–11; Donkin, Brit. Diat., pl. 2, fig. 4; Schmidt, Atlas, pl. 70, fig. 17; Nordsee Diat., pl. 2, figs. 16, 18; Van Heurck, Synopsis, pl. 10, fig. 3.)

The variety called var. *densestriata* in Schmidt's Atlas, plate 70, figures 14–16, is one of the forms found. It is another form common to both Campeche Bay and the Philippine Islands.

NAVICULA FORMICINA Grunow

(Schmidt, Atlas, pl. 160, figs. 38–41; Cleve, W. I. Diat., pl. 1, fig. 6.)

Another species confined exclusively to Campeche Bay and the Philippines.

NAVICULA FUNICULATA, new species

Plate 22, figs. 1–2

Valve very convex, oval-lanceolate, with blunt, slightly produced apices, the markings of which are not continuous with those of the rest of the valve; these latter consist of strong and well-seperated rows of cross-barred lines, set diagonal to the longitudinal axis of the valve, approaching the rhaphe but leaving an evident median line, which is slightly enlarged at the depressed central nodule into a circular hyaline area; rhaphe slightly bent, especially toward its outer ends, which terminate in beads some distance removed from the rounded apices of the valve; in side (girdle) view each valve is seen to be marked with heavy cross-barred lines above mentioned, except at each end where a triangular space occurs, marked with the same cross-barred lines, but running *at right angles to those on the rest of the valve;* the whole frustule is subrectangular, with an indentation at the center of each valve; the girdle is broad and hyaline.

Length, 0.070–0.087; width, 0.016–0.017; depth of frustule, 0.043 to 0.051; 4.5 lines in 0.01 mm.

This species has some affinity with those in Schmidt's Atlas, plate 46, figures 41–42 and 71–72, erroneously named in Fricke's Index and in Cleve's Naviculoid Diatoms (p. 30), var. *gregorii* Ralfs of *N. cancellata* Donkin. But if compared with *N. cancellata* Donkin itself, there is very little similarity, (Donkin, Brit. Diat., p. 55, pl. 8, fig. 4) nor with Ralf's *N. gregorii* (see Pritchard, Inf., p. 901 and Gregory, Glenshira Diat., p. 41, pl. 4, fig. 21, which equals *Pinnularia apiculata* Gregory). In face view the valve reminds one of *N. impressa* Lagerstedt (Diat. Bohus., p. 33, pl. 1, fig. 3) the costae of which, however, are smooth. In side view all resemblance disappears.

Type.—Cat. No. 43645, U.S.N.M.

NAVICULA FUSCA (Gregory) Ralfs

(Gregory, Diat., Clyde, p. 14, pl. 1, fig. 15; Donkin, Brit. Diat., pl. 1, fig 5; Schmidt, Atlas, pl. 7, figs. 2–4; Van Heurck, Synopsis, Supp., pl. B, fig. 24.)

For discussion of the boundaries of this species see *N. ingens*, new species.

NAVICULA GEMMATA Greville

(Greville, Cal. Guano, p. 30, pl. 4, fig. 7; Schmidt, Atlas, pl. 70, figs. 72–74.)

Several variations from the type, as var. *peristiophora* as well as the type form, were found.

NAVICULA GEMMULATA Grunow

(Schmidt, Atlas, pl. 13, figs. 19–21.)

NAVICULA GLABRISSIMA, new species

Plate 22, fig. 3

Valve wholly glabrous, narrowly oval, slightly prismatic in outline; convex; apices rounded, blunt; rhaphe strong, straight, ending in beads at the apices and the center; median area on either side of rhaphe very narrow

Length, .065–0.070; width, 0.023–0.026 mm.

This diatom gives no evidence of surface markings under the best 1.8 oil-immersion objective, with either direct or oblique illumination. The specimens might be considered to be immature or auxisporial forms were it not for the perfect finish of the entire frustules, including rhaphe. Rare found only at Jolo Jolo, Sulu Islands.

Type.—Cat. No. 43646, U.S.N.M.

NAVICULA GRAEFFII Grunow

Plate 22, fig. 4

(Schmidt, Atlas, pl. 7, figs. 5–6; pl. 8, fig. 33; and Cleve, Nav. Diat., vol. 1, p. 93.)

Another species common to both Campeche Bay and the Philippine Islands. It also occurs in the nearby islands of Celebes and Java.

NAVICULA (ALLOIONEIS) GRUENDLERI Cleve

See *N. inexacta,* new name.

NAVICULA HAMULIFERA Grunow

(Cleve, Nav. Diat., vol. 1, p. 154, pl. 3, figs. 16–19.)

NAVICULA HENNEDYI W. Smith

(Gregory, Glenshira Diat., pl. 5, fig. 3; Donkin, Brit. Diat., pl. 2, fig. 3; Schmidt, Atlas, pl. 3, fig. 18; Van Heurck, Synopsis, pl. 9, fig. 14.)

As above mentioned, the including here of *N. clavata* Gregory is unwarranted. This common species occurs in both Campeche Bay and the Philippine Islands.

NAVICULA HOSPES A. Schmidt

(Schmidt, Atlas, pl. 8, fig. 32.)

So far as I know, this unique diatom has been found elsewhere only at Samoa.

NAVICULA IMITANS, new species

Plate 22, figs. 5–6

Valve broadly oval with produced, rounded apices; marked with closely set rows of small well-rounded beads, the rows diagonal to the longitudinal axis, barely so at the middle of the valve, progressively more so toward the apices; the beading interrupted by a double-lyrate or H-shaped hyaline design similar to that of the type form of *N. lyra* Ehrenberg, its four horns wide apart, slightly connivant toward their ends, stopping short of the sides of the valve; the two halves of the rhaphe straight except at the apical ends, where they are sharply twice bent or hooked, the ends at the center approaching closely and enlarged.

Length, 0.090–0.168; width, 0.053–0.083; 14.3 lines in 0.01 mm.

This diatom is abundant in the Philippine Islands and is very uniform in appearance. It resembles wide varieties of *N. lyra* Ehrenberg and of *N. approximata* Greville. Naviculae with a double-lyrate design occur in great variety. It would be a disadvantage to attempt their classification under a single specific name.

Type.—Cat. No. 43647, U.S.N.M.

NAVICULA INDICA Greville

(Micro. Journ., 1862, pl. 9, fig. 13.)

De Toni (Syl. Alg., p. 105) makes this *N. macraei* Rabenhorst on the basis of a too meager description, and without illustration, in Rabenhorst's Flora Europaea Algarum, volume 1, page 226. Without much question, it should rather be taken to be a variety of *N. clavata* Gregory, where the hyaline H-shaped area is charged with a heavy granulation. If this view were taken the name of Gregory would have precedence, 1856.

NAVICULA INDIGENS, new species

Plate 23, fig. 1

Valve elliptical, massive, cross-barred with heavy costae, which are finely rugose but not beaded except near their pointed marginal ends, where each bears a single large bead, the beads thus forming a strong row parallel with and slightly distant from the margin of the valve; a single row of similar beads running on either side of the rhaphe, slightly distant from the inner ends of the costae and equaling them in number; rhaphe heavy, straight, its ends at the center distant, its apical ends not reaching the margin; a conspicuous hyaline area at each apex.

Length 0.096–0.129; width 0.037–0.068; lines 3–3.5 in 0.01 mm.

This species belongs to the *N. crabro* Ehrenberg-*N. pandura* Brébisson group, but can not be united with either as a variety without doing violence to any workable image of those species. It is quite abundant in the Philippine Islands.

Type.—Cat. No. 43648, U.S.N.M.

NAVICULA INEXACTA, new name

Plate 22, fig. 7

This is what Cleve and Grunow name *Alloioneis grundleri* Cleve (West Ind. Diat., p. 7, pl. 2, fig. 10), but the genus as constituted by Schumann (Diat. H. Tatra, 1867, p. 73) and accepted by Cleve, is too loosely defined and too uncalled for to justify its adoption. Cleve himself abandons this arrangement (Nav. Diat., vol. 2, p. 51). Such forms would naturally be recognized as *Naviculae*, and therefore to call them something else is to complicate rather than simplify taxonomy. But to change this into *Navicula grundleri*, as is done by Cleve in his Naviculoid Diatoms (vol. 2, p. 51, 1896), is to upset *N. grundleri* A. Schmidt, in Schmidt's Atlas, plate 12, figure 35, published August 1, 1885. I have therefore renamed it *N. inexacta*, referring to the broken pattern of the markings and the unsymmetrical rhaphe.

This is another species found in both Campeche Bay and the Philippine Islands.

NAVICULA INGENS, new species

Plate 22, fig. 8

Valves broadly elliptical, closely set with beading of two kinds; in the wide areas along either side, representing something over one-third the width of the valve, the beading is massive, arranged in regular rows, transverse at the middle and increasingly radial toward the ends of the valve, the lines and the beads so closely set that many of the latter are rectangular by lateral pressure; the second kind of beading, that of the narrow elliptical central area, which is less than one-third the width of the valve and bisected by the rhaphe line and extending clear to the ends of the valve, is covered by equally closely set but much smaller beading, arranged in double rows, in zigzag formation, each double row continuous with the coarser single rows of the outside area and extending inward to the rhaphe line; the rhaphe is heavy, reaching to the ends of the valve; the hyaline area of the central nodule is small and oval.

Length, 0.13; width, 0.053; lines, 6.5 in 0.01 mm.

This species belongs to the *Navicula fusca* group. Its outer beading is similar to that species, but much coarser and denser; its inner double beading is similar to that of *N. smithii* Brébisson. There is a great confusion between these two latter and *N. aestiva* Donkin. The muddle is not at all helped by Cleve's attempt in Naviculoid Diatoms, volume 1, page 93, where he excludes the figure and description of *N. fusca* in Donkin's British Diatoms, page 7, plate 1, figure 5, making it *Diploneis borealis* (Grunow) Cleve and includes the utterly irrelevant *N. subfusca* Pantocsek, var. *oamaruensis* Cleve, which he figures on his plate 2, figure 3. A careful study of these related forms, in which the Philippine Islands gatherings are quite rich, makes it evident that we have three or perhaps four well-marked types. In *N. smithii*, a species of broadly oval shape, the beading is always in double rows between costal lines, both in the outer portion of the valve and in the inner elliptical portion, the double beading of the latter however being fainter. In *N. aestiva* the beading is delicate, in single rows without costal lines, both in the outer portions and in the elliptical central portion. In *N. fusca* (based on "*N. smithii* var. *B. fusca* Greg." in Diatoms of the Clyde, p. 486, pl. 9, fig. 15) the beading is also in single rows in both inner and outer portions, but so much more massive than that of *N. aestiva* that the two can only with difficulty be taken as variations of each other; the central part of *N. aestiva* being also much less angular in outline than that of *N. fusca*. In the new species here presented we have a fourth form, where the beading of the outer portions is even more massive than in *N. fusca*, while the strongly contrasting central portion is covered with double rows of fine beading separated by costal lines. That this never occurs in *N. fusca* is shown by the careful drawing by Tuffen West of the original type in Diatoms of the Clyde, plate 9, figure 15, in the figure in Donkin's British Diatomaceae, plate 1, figure. 5, also by Tuffen West; in the figure in Schmidt's Atlas, plate 7, figures 1–4; in Peragallo's Diatomées de France, plate 20, figures 6–7; and in the express statement of Gregory above cited; in the statement by Ralfs in Pritchard's History of Infusoria, page 899; in that of Donkin's British Diatomaceae, page 7; and that of De Toni in Sylloge Algarum, page 87.

Type.—Cat. No. 43649, U.S.N.M.

NAVICULA INHALATA A. Schmidt

Plate 23, fig. 2

(Schmidt, Atlas, pl. 2, fig. 30.)

I have figured the form of Philippine Islands diatoms which I have assigned to this species because there is some doubt that the two are the same. Schmidt's type came from Samoa and Pantocsek reports it and his var. *biharensis* from the fossil beds in Hungary. The resemblance of both these to *N. spectabilis* Gregory is evident.

NAVICULA INTERCEDENS A. Schmidt

(Schmidt, Atlas, pl. 160, figs. 3–4.)

This is another species exclusive to Campeche Bay and the Philippine Islands. It is not to be confused with *N. musca* Gregory (Schmidt, Atlas, pl. 160, figs. 1–2).

NAVICULA INVENUSTA Mann

(Mann, Diat., Alb. Voyages, p. 346, pl. 53, fig. 6.)

NAVICULA IRIDIS Ehrenberg

(Donkin, Brit. Diat., pl. 5, fig. 6; Van Heurck, Synopsis, pl. 13, fig. 1; Schmidt, Atlas, pl. 49, fig. 2.)

Infrequent specimens of this fresh-water diatom appear in the marine Philippine material, probably introduced with other detritus from inflowing rivers or streams.

NAVICULA JEJUNA A. Schmidt

(Schmidt, Atlas, pl. 46, fig. 16; Castracane, Chall. Exp., pl. 20, fig. 12.)

NAVICULA JUGATA Cleve

See remarks under *N. bigemmata*, new species.

NAVICULA LACRIMANS A. Schmidt

(Schmidt, Atlas, pl. 12, figs. 59–60.)

The placing of this under *N. gemmatula*, Grunow, in Fricke's Index, can not be sustained. It is doubtful if var. *fossilis* Pantocsek in Hungarian Diatoms, part 2, plate 2, figure 18, is close enough for a mere variety. The type form was from Campeche Bay, another instance of diatoms peculiar to that locality and the Philippine Islands.

NAVICULA LIBER W. Smith

(Smith, Brit. Diat., p. 48, pl. 16, fig. 133; Schmidt, Atlas, pl. 50, figs. 16–18; Van Heurck, Synopsis, pl. 12, fig. 36.)

Varieties of this approach varieties of *N. maxima* Gregory, but the two should be recognized as distinct.

NAVICULA LITTORALIS Donkin

(Donkin, Brit. Diat., p. 5, pl. 1, fig. 2; Schmidt, Atlas, pl. 7, fig. 12; Van Heurck, Synopsis, Supp., pl. B, fig. 25; H. L. Smith, Types, No. 291.)

This is like, possibly identical with *N. ovulum* Grunow (N. Ung. Gek. Diat., pl. 1, fig. 19; and Schmidt, Atlas, pl. 70, fig. 13).

NAVICULA LONGA (Gregory) Ralfs

(Donkin, Brit. Diat., pl. 8, fig. 3; Schmidt, Atlas, pl. 47, fig. 68.)

Another species occurring at both Campeche Bay and the Philippine Islands.

NAVICULA LYRA Ehrenberg

(Ehrenberg, Amer., pl. 1, sec. 1, fig. 9*a*; Gregory, Diat., Clyde, pl. 1, fig. 13; Schmidt, Atlas, pl. 2, figs. 24–25; pl. 3, figs. 11–12; Van Heurck, Synopsis, pl. 10, figs. 1–2.)

The type form of this cosmopolitan species is not common in the Philippine Islands, but is mainly represented by several of its many varieties, as var. *recta* (Schmidt, Atlas, pl. 2, fig. 18), var. *subcarinata* (Schmidt, Atlas, pl. 2, fig. 5). Var. *insignis* (Schmidt, Atlas, pl. 2, fig. 27), and var. *elliptica* (Schmidt, Atlas, pl. 2, fig. 34) also present, hardly belong to this category and might receive separate names.

NAVICULA MADAGASCARENSIS Cleve

Plate 25, fig. 4

(Le Diat., vol. 1, p. 23, pl. 4, fig. 2.)

The type locality was Tamatava, Madagascar. A very robust form of this rare diatom is here figured, the measurements of which are—

Length, 0.110; width, 0.056; lines, 6.5 in 0.01 mm.

NAVICULA MARGARITA A. Schmidt

(Schmidt, Atlas, pl. 174, fig. 17.

This species is also exclusively a Campeche Bay-Philippine Islands form.

NAVICULA MARGINATA Lewis

(Lewis, New and Rare Diat., p. 62, pl. 2, fig. 1; Schmidt, Atlas, pl. 160, figs. 21, 28, 31.)

This strikingly beautiful and variable diatom is widely dispersed. Among other places it is found both at Campeche Bay and the Philippine Islands, especially the variety which Castracane calls *N. janischii* in the Report of the Challenger Expedition, plate 30, figure 5, and to which Cleve has appended the unnecessary term, "forma *brevis*." Its artful simulation of the genus *Mastogloia* caused Brun and Grunow to put varieties of it in that genus, and Cleve to name a variety without the usual median constriction "*Dictyoneis thumii*" (Cleve, Nav. Diat., vol. 1, pl. 5, fig. 33).

NAVICULA MAXIMA Gregory

(Gregory, Glenshira Diat., pl. 4, fig. 19; Schmidt, Atlas, pl. 50, figs. 19–21, 33, 36.)

The resemblance of this species to *N. liber* W. Smith causes De Toni (Syl. Alg., p. 158) to remove Gregory's own example in Diatoms of the Clyde, plate 1, figure 13, to *N. liber.*, as well as that of

Ralfs in Pritchard, Infusoria, plate 7, figure 75. Lagerstadt (Diat., Bohusl., p. 43.) names a specimen, *N. liber*, var. *maxima.* Admitting the nearness of some of the varieties to each, it is best to keep the dissimilar types in separate species.

NAVICULA MENDICA, new species

Plate 23, fig. 3

Valve convex narrow, lanceolate, the sides running straight from middle to apices, which are not produced but are rounded and massive because of a thickening of the silica wall; markings of short, beaded, slightly diagonal lines in four rows, two inner and two marginal; all four rows have the lines set wide apart, the interspaces being twice the width of the lines; the two marginal rows are alike, their lines very short; the two inner rows are unlike, one being close to and parallel with the rhaphe and made up of very short lines, the other of longer lines, midway between the margin and the rhaphe and parallel with the margin; rhaphe straight, the middle ends approaching closely, the outer ends stopping short of the apices.

Length, 0.062; width, 0.016; 4.7 lines in 0.01 mm.

That this is close to *N. biseriata* Petit (Journ. Roy. Micro. Soc., 1878, p. 241, pl. 32, fig. 33) and to *N. richardsoniana* O'Meara (Irish Diat., p. 339, pl. 32, fig. 33) is evident; but it differs from both by its very angular outline, by the unsymmetry of median rows of lines, and by the shortness of these lines in three of the four rows. It further differs from *N. richardsoniana* in the remoteness of the rhaphe ends from the apices of the valve, and from *N. biseriata* in the absence of the "semistauros" at the central nodule. In other words, there is, with a certain resemblance, the same degree of valid difference between these as between *N. californica* Greville and *N. kennedyi* W. Smith. O'Meara says his species closely resembles *N. nitescens* Gregory, which it certainly does; but it would be difficult to trace any resemblance between that diatom and the present species. While dealing with the above combination it may be in place to remark that to those who can not accept Cleve's subdivision of the genus *Navicula* as of generic rank, his arbitrary changing of *N. biseriata* Petit into *Caloneis biseriata* (Petit) Cleve and then appropriating that name for another *Navicula*—"*Diploneis biseriata* Cl."—causes much confusion. This latter diatom I have also found in the Philippine Islands and my position, with that of Van Heurck and many other diatomists being against the dismemberment of *Navicula*, has compelled me to give to Cleve's species a new name *Navicula mimula* Mann, which see.

Type.—Cat. No. 43650, U.S.N.M.

NAVICULA MEXICANA (Heiden) Mann

(Schmidt, Atlas, pl. 264, figs. 3, 7.)

This is named in the above *Caloneis mexicana*, a genus the validity of which is here denied.

NAVICULA MIMULA, new name

Plate 23, fig. 4

As was mentioned under *N. mendica* Mann, this diatom is probably a variety of "*Diploneis biseriata* Cl." (Nav. Diat., vol. 1, p. 102, pl. 2, fig. 16) although the biserial quality is here lacking, as there is only a single series of beads on either side of the valve. But the shape, general sculpture, including the hyaline apical areas and the straight rhaphe in both, makes any specific distinction undesirable. As has been said, Cleve's appropriation of the name *biseriata* for this form makes it necessary for those who do not follow his classification to give another name to the present species, so as to avoid confusion with *Navicula biseriata* Petit (Journ. Roy. Micro. Soc., 1878, pl. 14, fig. 15). It may be said at this place that the use of one specific name for two diatoms that will undoubtedly be considered by some diatomists as belonging to the same genus is as unfortunate as it is unnecessary.

Length, 0.093; width, 0.036; 3.6 lines in 0.01 mm.

This diatom is rare.

NAVICULA MIRABILIS Leuduger-Fortmorel

(Leuduger-Fortmorel, Diat., Ceyl., p. 31, pl. 2, fig. 21.)

This rare diatom, found heretofore only in Ceylon, should not be confused with the later named (1879 and 1886) *N. mirabilis* Castracane (Chall. Exp., pl. 30, fig. 10). The last De Toni renames *N. philippinica* (Syl. Alg., p. 87).

NAVICULA MOLESTA, new species

Plate 23, fig. 5

Valve very convex, long-elliptical or fusiform in outline, with gently curved sides and rounded apices; markings of finely set, beaded lines, all radial, almost reaching to the rhaphe, at the center more loosely spaced, resulting in an imperfect, flaring, stauroslike, lateral extension of the central area; rhaphe rigidly straight, its central ends almost touching.

Length, 0.085; width, 0.023; 18 lines in 0.01 mm.

It has some resemblance to the much coarser, fresh-water, *N. bottnica* Grunow, the original material of which is in H. L. Smith, Types, No. 682, and the original figure in Van Heurck's Synopsis, plate 7, figure 33; also to *N. digito-radiata* Gregory, well illustrated in Peragallo's Diatomaceae of France, plate 12, figure 28, and to *N. solaris* Gregory, in the Microscopical Journal for 1856, plate 5, figure 16. My specimens came from Jolo Jolo, and are of striking delicacy.

Type.—Cat. No. 43651, U.S.N.M.

NAVICULA MULTICOSTATA Grunow

(Grunow, N. Ung. Gek. Diat., pl. 1, fig. 13; Schmidt, Atlas, pl. 11, figs. 14, 20; pl. 12, figs. 71–72.)

Rather generally held to be a phase-form of *N. crabro* Ehrenberg. The variety shown in Schmidt's Atlas, plate 11, figure 20 is common to both Campeche Bay and the Philippine Islands.

NAVICULA NEBULOSA Gregory

(Gregory, Diat., Clyde, pl. 1, fig. 8; Donkin, Brit. Diat., pl. 2, fig. 2; Schmidt, Atlas, pl. 3, fig. 14.)

This species is similar to *N. hennedyi* W. Smith and some authors have published it as a variety of that species. But it is much more delicately formed and sculptured, appearing constant from a great many localities.

NAVICULA NITESCENS Ralfs

(Donkin, Brit. Diat., pl. 1, fig. 7; Schmidt, Atlas, pl. 7, figs. 37–41; Gregory, Diat., Clyde, pl. 1, fig. 16.)

This species is common to both Campeche Bay and the Philippine Islands.

NAVICULA NOTABILIS Greville

(Micro. Journ., 1863, p. 18, pl. 1, fig. 9.)

The original locality is unknown. I have found it also in material from Hilo, Hawaiian Islands.

NAVICULA NUMMULARIA Greville

(Greville, Cal. Guano, p. 30, pl. 4, fig. 6.)

This is close to *N. forcipata* Greville.

NAVICULA OAMARUENSIS Grunow

(Schmidt, Atlas, pl. 129, fig. 9; pl. 204, fig. 13.)

I do not like this identification; but my specimens are so nearly like this hitherto local, fossil species that a new name is not justified.

NAVICULA OBESA (Greville) Mann

Plate 23, fig. 6; plate 24, fig. 1

This is Greville's *Stauroneis obesa,* in Diatoms from the South Pacific, page 237, plate 3, figure 12. Under my *Cocconeis citronella,* new species, the under valve of which is strikingly similar to this diatom, I have mentioned the fact that Cleve rather arbitrarily united this and the unnamed specimens figured in Schmidt's Atlas, plate 198, figures 35, 36, and 40, because he failed to consider that Greville might have been dealing with an unquestionable *Navicula* ("*Stauroneis*") proven by both valves being identical in markings and both having rhaphes. By means of such specimens I have been able to reestablish the validity of Greville's classification, and I include two photographs for comparison with that of the under valve of *C. citronella.* It will be seen that the identity claimed by Cleve is deceptive, because both in form and in the pattern and coarseness of the beading there are easily overlooked but genuine differences. Thus Greville's type form gives 8.5 to 9.5 lines in 0.01 mm., my typical specimen 9.4 and my varietal specimen 9.2 lines in 0.01 mm., while Cleve says that the corresponding valves in his combination give 21 to 25 lines in 0.01 mm. The arrangement of the lines is also different, as is especially evident about the center of the valve and adjacent to the small stauros.

NAVICULA OCELLATA, new species

Plate 24, fig. 2

Valve an accurate oval, crossed by fine, closely set unbeaded lines, leaving a lenticular median area about one-quarter the width of the valve, which gradually narrows to a mere thread at the apices; a row of similiar but very short beaded lines on either side of the rhaphe somewhat flared outward at their beginning near the center, and stopping somewhat short of the apices, to which the raphe continues; rhaphe line depressed; a large central nodule; the inner ends of the rhaphe bent right and left above and below it; on either side of the center the crosslines are interrupted by two indentical large ovate hyaline areas or ocellae; occasionally one of these is more obscure than the other, though not wanting entirely; rim stout and hyaline; crosslines transverse only at the middle, progressively curved outward as they approach the apices.

Length, 0.062–0.082; width, 0.026–0.037; 11 to 14 lines in 0.01 mm.

A slight resemblance to this species is found in the rather questionable figure of "*Stauroneis robusta*" Petit, as given in Peragallo's Diatomees, France, plate 29, figure 9, the original figure being in Petit Journal of Royal Microscopical Society, 1878, plate 15, figure 16.

Type.—Cat. No. 43652, U.S.N.M.

NAVICULA OPHIOCEPHALA Cleve and Grove

(Le Diat., vol. 1, p. 57, pl. 9 fig. 13; Schmidt, Atlas, pl. 212, fig. 6.)

NAVICULA OSCITANS A. Schmidt

(Schmidt, Atlas, pl. 6. fig. 41.)

What is called var. *subundulata* Cleve and Grove in Le Diatomiste, page 67, plate 10, figure 10, is not a variety of this but a separate species and is here included as *N. suboscitans*, which see.

NAVICULA O'SWALDII Janisch

(Schmidt, Atlas, pl. 70, fig. 46.)

I follow here the lead of other diatomists in recording this as separate from *N. excavata* Greville, but the two are not satisfactorily distinguishable.

NAVICULA PACIFICA (Castracane) Mann

(Castracane, Chall. Exp., p. 23, pl. 20, fig. 9.)

This is placed in the genus *Stauroneis* by Castracane, an ill-defined and to me unnecessary separation from the genus *Navicula.*

NAVICULA PANDURA Brébisson

(Brébisson, Diat. Cherb., p. 15, pl. 1, fig. 4; Schmidt, Atlas, pl. 11, figs. 1–2; Van Heurck, Synopsis, pl. 9, fig. 1.)

As stated under *N. crabro* (Ehrenberg) Kützing, I do not recognize this to be a variety of that species.

NAVICULA PARTITA, new species

Plate 24, fig. 3

Valve narrow panduriform, the median constriction broad and gently concave; the greatest width of each half of the valve is midway between the center and the apex, the apical part being somewhat wedge-shaped; on either side of the valve extends a marginal band of short, heavy costae ending inwardly in a bead, the interspaces between the costae being hyaline except for an obscure rounded blotch near the margin; the width of this band varies in exact proportion to the width of the valve, being widest midway between the center and the apices and narrowing to the middle and to the apices; the longitudinal central area of the valve bisected by the rhaphe line is crossed by continuations of the costae in the outer bands; but these continuations are broad, flat, and indistinct; no rows of beads bordering the sides of the rhaphe; a small but conspicuous rectangular central nodule; rhaphe straight, ending in beads at the apices and at the center, the latter touching the rectangular central nodule.

Length, 0.104–0.107; width, 0.031–0.037; 3 lines in 0.01 mm.

One is here reminded of *N. coarctata* A. Schmidt (Atlas, pl. 11, fig. 30, and pl. 174, fig. 22) and even more so of *N. exempta* A. Schmidt (pl. 11, fig. 29) although the original figure of the latter in Schmidt's Nordseef. Diatomaceen, plate 2, figure 5, shows less similarity. The marking, especially the absence of rows of beading next to the rhaphe line, sets this diatom off as a distinct species.

Type.—Cat. No. 43653, U.S.N.M.

NAVICULA PATRICIA, new species

Plate 24, fig. 4

Valve of the *N. crabro* form, but deeply constricted at the middle, the two halves ovate, tapering to the rounded ends; markings in three series; an outer band of coarse rectangular divisions, obscurely double-headed, widest at the center of each half, narrowing toward the ends and disappearing at the constricted middle portion of the valve; within this outer band and continuous with its divisions, coarse and perfectly smooth bars, reaching to the third of the series of markings, these last bordering the central rhaphe area; like the outer band, these coarse median bars decrease in length toward the apices and disappear entirely at the constricted middle area of the valve; the third series of markings, running on either side of the rhaphe, correspond in number to the divisions of the other two series; they are coarse, rectangular, increasing regularly in size from the apices of the valves toward the middle, where they replace the other two series and form the only markings between the central nodule and the margin; the rhaphe is massive, its inner ends very widely separated, the central nodule thus left being rectangular, its longer axis corresponding with that of the valve.

Length 0.082; width 0.023; 6 lines in 0.01 mm.

The only species at all closely resembling this is *N. coarctata* A. Schmidt, figured in Schmidt's Atlas, plate 11, figure 30, and plate 174, figure 22. It is rare in the Philippine Islands. One specimen has been found also at the Galapagos Islands.

Type.—Cat. No. 43654, U.S.N.M.

NAVICULA PELAGI A. Schmidt

(Schmidt, Atlas, pl. 7, fig. 26.)

Fricke's Index records the above figure as a variety of *N. fusca* (Gregory) Ralfs, to which I do not agree. This species is another example of diatoms peculiar to Campeche Bay and the Philippine Islands.

NAVICULA PETITIANA Grunow

(Cleve, New and Little Known Diat., pl. 3, fig. 34; Schmidt, Atlas, pl. 212, figs. 26–29.)

NAVICULA PHILIPPINARUM, new species

Plate 25, fig. 1

Valve broadly oval, marked by a broad marginal band of strong beading set in radially directed rows, which are not closely placed but separated by interspaces as wide, or sometimes twice as wide as the rows, the beads in each row also not being crowded but slightly separated; short interpolated rows next to the margin not infrequent, this outer band is of nearly equal width except at the middle where it is suddenly widened and close to the two ends where it is rapidly narrowed and disappears, leaving a small triangular hyaline space beyond each end of the rhaphe; rhaphe straight, strong, sharply hooked toward the same side at the outer ends, the inner ends well separated; short and similar rows of beads run parallel to the rhaphe on either side, they are narrowest at the outer ends and widest at the center of the valve; the rest of the valve is loosely spattered with larger but shadowy beads, showing a tendency to a radial arrangement.

Length, 0.079–0.125; width, 0.059–0.087; 3.7 lines in 0.01 mm.

Very clearly this brilliantly sculptured diatom is in that large group of *Naviculae* of which *N. excavata* Greville and *N. caribaea* Cleve are typical. But when compared, it can not be united as specifically identical with any of them, however difficult it might be to draw a clear line of distinction between them by means of an unillustrated description. It is the most abundant *Navicula* in the Philippine dredgings, including those from the Sulu group. It is of unvarying uniformity as to its markings and all specimens are relatively large.

Type.—Cat. No. 43655, U.S.N.M.

NAVICULA PINGUIS Mann

(Mann, Diat., Alb. Voyages, p. 350, pl. 53, fig. 5.)

The original type form was from Bering Sea.

NAVICULA PLICATULA Grunow

Plate 24, figs. 8–9

(Cleve, Nav. Diat., vol. 1, pl. 3, fig. 28; Castracane, Chall. Exp., pl. 28, fig. 13, unnamed.)

This is the unnamed *Navicula* in Report of the Challenger Expedition, plate 28, figure 13, from Tahiti. It is also very probable that *N. parallela* Castracane shown in the same work, plate 28, figure 12, is the same species, although the two figures seem to be quite different. For in Philippine Islands material I have found all transitions between these two, both as to straight or undulating rhaphe and as to bluntly oval or appressed apices. A study and measurement of a large series indicates beyond much doubt that this difference is merely a varietal one. The average length of my specimens is 0.084 to 0.138 mm., and the width from 0.031 to 0.038 mm. All are strongly convex, very diaphanous, with identical markings, namely, very fine transverse beaded lines; all have about 18 lines in 0.01 mm., measured midway between center and apex of valve; all have a shadowy line parallel to the margin running midway between the margin and the center on eace side of the rhaphe. This smaller central oval or ellipse, thus dimly marked out, Cleve refers to as a "slight depression." If therefore plate 28, figure 12, and plate 28, figure 13, as shown in the Report of the Challenger Expedition, are identical

N. parallela Castracane (1886) would replace *N. plicatula* Grunow (1894). But as there still may be some doubt about this identity I accept Grunow's name and include here only the unnamed figure given in the Report of the Challenger Expedition, plate 28, figure 13 The fact that Castracane saw a difference between this figure and his *N. parallela* makes the decision to leave the latter out of this combination a safe one, despite the suspicious similarity above noted. I give here an illustration of the typical form with undulating rhaphe and of the variety with straight rhaphe.

NAVICULA PRAETEXTA Ehrenberg

(Gregory, Diat., Clyde, pl. 1, fig. 11; Schmidt, Atlas, pl. 3, figs. 30–34; Van Heurck, Synopsis, pl. 9, fig. 13.)

This species is represented by many variations in the Philippine Islands.

NAVICULA PRISTIOPHORA Janisch

(Schmidt, Atlas, pl. 70, fig. 72.)

The only previously recorded locality for this species is Leton Bank. Fricke's Index incorrectly makes it a variety of *N. gemmata* Greville.

NAVICULA PROBABILIS A. Schmidt

(Schmidt, Atlas, pl. 50, fig. 46.)

Although the specific name is an implication of uncertainty on the part of Schmidt, I think its separate rank is worth while. It is another species found only at Campeche Bay and the Philippine Islands.

NAVICULA PRODIGA Mann

(Mann, Diat., Alb. Voyages, p. 352, pl. 53, fig. 4.)

The type specimen came from the Hawaiian Islands.

NAVICULA PSEUDO-CLAVATA, new species

Plate 25, fig. 2

Valve broadly elliptical, with produced, rounded ends; sides in the middle portion nearly straight; markings of very fine, closely set rows of beading, radial and parallel to each other near the margin, becoming wavy toward the center; the rows interrupted by long narrow hyaline spaces extending diagonally from near the apices on each side the rhaphe toward but not reaching, the middle of the valve, and also by a small flaring central stauros; rhaphe straight, ending in beads at the middle and in minute hooks turned to the same side at the apices.

Length, 0.141; width, 0.073; 11.5 lines in 0.01 mm.

With this may be compared *N. transfuga* Grunow in Cleve's Vega Diatoms, plate 35, figure 15, from Seychelles Islands and a doubtful variety of the same in Schmidt's Atlas, plate 204, figure 17.

Type.—Cat. No. 43656, U.S.N.M.

NAVICULA PUDENS, new species

Plate 26, fig. 3

Valve, narrow elliptical, with rounded ends; crossed by coarse rows of beading, the rows as well as the beads in each row not closely set; rows strictly transverse except near to the ends of the valve; outside bead in each row larger than the rest, thus forming a marginal series around the valve and slightly distant from the hyaline rim; longitudinal median area one-fifth the width of the valve, slightly broadened at the center to form an oval hyaline median area; rhaphe inclosed by parallel ridges on each side, straight, the middle ends widely separated.

Length, 0.047: width, 0.014; 7 lines in 0.01 mm.

This is practically the same diatom as the unnamed form in Schmidt's Atlas, plate 7, figure 49, from Campeche Bay. It also is closely related to *N. sejuncta* A. Schmidt (Nordsee Diat., pl. 1, fig. 18, and Schmidt, Atlas, pl. 212, figs. 9–10).

Type.—Cat. No. 43657, U.S.N.M.

NAVICULA PUELLA A. Schmidt

(Schmidt, Atlas, pl. 12, figs. 13–15; pl. 69, figs. 15–25.)

The making this a variety of *N. splendida* Gregory in Fricke's Index is open to doubt, at least in the case of plate 12, figures 13–14, and plate 69, figure 15, above. It is another diatom common to both Campeche Bay and the Philippine Islands.

NAVICULA PUGIO, new species

Plate 26, fig 4

Valve convex, narrow lanceolate, tapering from the middle to the acute apices; markings of diagonally directed parallel rows of coarse, round or oval beads, the rows, as well as the beads in each row, somewhat distant; a flaring central stauros extending almost to the sides and depressed below the beaded portions of the valve; rhaphe not reaching the apices, its middle terminations almost touching and slightly bent to one side.

Length, 0.110; width, 0.017; 5 lines in 0.01 mm.

This very narrow and coarsely marked diatom belongs to the *N. aspera* Ehrenberg group. It is somewhat rare.

Type.—Cat. No. 43658, U.S.N.M.

NAVICULA PULVULENTA, new species

Plate 25, fig. 3

Valve long, hexagonal, with straight, parallel sides and wedge-shaped ends; slightly convex and slightly depressed transversely across the middle; at the margin the valve bends quickly downward to form vertical sides which join with the girdle; a thin hyaline line marks this marginal bend and extends around the entire valve, including its apices; entire surface of the valve, including the vertical sides, dotted with small widely separated beads, showing a slight tendency to form transverse rows; a small oval hyaline area at the center; rhaphe very slightly sinuous, its middle terminations distant and bent in opposite directions.

Length, 0.090–0.099; width, 0.030–0.033 mm.

This delicate and peculiarly ornamented species reminds one of *N.* (*Alloioneis*) *grundleri* Cleve and Grunow, also found in the Philippine Islands material and figured in Cleve's West India Diatoms, plate 2, figure 10, and here recorded under the new name *N. inexacta* Mann, and illustrated on plate 22 figure 7 for comparison as a Philippine Islands form.

Type.—Cat. No. 43659, U.S.N.M.

NAVICULA RAEANA (Castracane) Cleve

(Castracane, Chall. Exp., p. 25, pl. 15, fig. 3.)

Cleve's idea (Nav. Diat., vol. 2, p. 69) that this species may be a variety of *N. yarrensis* Grunow can not be commended. In general shape, in the character of its rhaphe and in its costal markings it is clearly distinct. The original type form also came from the Philippine Islands.

NAVICULA RECTANGULATA Gregory

(Gregory, Diat., Clyde, p. 7, pl. 9, fig. 7; Donkin, Brit. Diat., pl. 10, fig. 5; Van Heruck, Synopsis, Supp., pl. A, fig. 7.)

NAVICULA RETINENDA A. Schmidt

(Schmidt, Atlas, pl. 212, fig. 17.)

Schmidt's contention that this form offers satisfactory distinctive mark from *N. liber* W. Smith seems to be correct. The type specimen came from the not distant Sumbawa, East Indies.

NAVICULA RETROSTAUROS, new species

Plate 25, fig. 5; plate 26, figs. 1–2

Valve quite convex, narrow oval or spindle-shaped, the sides sloping from the middle gently to the rounded ends; covered with fine closely set lines diagonal to the long axis and rather obscurely beaded, the beading of each line being slightly irregular, resulting in a faint wavy appearance in the sculpture; interrupted by a faint but persistent longitudinal line on each side near to the margin and parallel with it; at the center a strong stauros, at first narrow but suddenly broadened out at the outer ends into triangular enlargements and just touching the two faint longitudinal side lines above mentioned; this stauros perceptibly sunken in the surface of the valve, so that its vertical side boundaries are strongly accentuated; rhaphe a trifle tortuous, especially near the center, its outer ends curved and reaching the apices of the valve, its inner ends well separated; in side (girdle) view the sunken stauros shows as a deep central notch.

Length, 0.090–0.141; width, 0.029–0.035; lines, 10.6–11 in 0.01 mm.

Compare with *N. impleta* Cleve and Grove (Le Diatomiste, p. 58, pl. 1, figs. 1–2) from Macassar Straits, and *N. crucifix* Tempère and Brun, Diatomées du Japon (p. 42, pl. 7, fig. 10) fossil at Sendai, Japan.

Type.—Cat. No. 43660, U.S.N.M.

NAVICULA RHOMBICA Gregory

(Micro. Journ., 1856, pl. 5, fig. 1, Cleve, Nav. Diat., vol. 1, p. 152.)

There is some question as to this species being a true *Navicula*, chiefly because of its peculiar rhaphe, which is heavy, rodlike, with ends terminating at some distance from the apices of the valve. Nevertheless, as no other assignment seems to be more satisfactory, this one is provisionally adopted. Specimens from recent dredgings from the Philippine Islands as well as from other localities do not agree exactly with Brun's form from the fossil deposit at Sendai Japan, *Navicula* (*Schizonema*) *japonica* (Brun) Cleve (Brun Espec. Nouv., pl. 14, fig. 6), but the two can hardly be separated. Somewhat similar is *Brebissonia weisflogii* Grunow (Cleve, W. I. Diat., pl. 1, fig. 9).

NAVICULA ROBUSTA Grunow

(Schmidt, Atlas, pl. 50, figs. 1–2.)

NAVICULA SAMOENSIS Grunow

(Schmidt, Atlas, pl. 50, figs. 43–44.)

NAVICULA SEDUCTILIS A. Schmidt

(Schmidt, Atlas, pl. 2, fig. 35.)

That this is a mere variety of *N. lyra* Ehrenberg, as claimed by O' Meara, De Toni, and others, may be doubted.

NAVICULA SEMISTAUROS, new species

Plate 26, fig. 5

Valve convex, spindle-shaped, with narrow, rounded apices, unsymmetrically marked on its two sides; one side having closely set diagonal beaded lines, broken here and there by wider spacing between the beads and also by single beads being larger than the rest, these two irregularities producing a wavy appearance in the markings; a central stauros is also unsymmetrical, its half on this side being very small, while on the other side it is strong, flaring, and reaches about halfway to the margin; the rows of beading on this last-mentioned side having the flaring half stauros, are even more irregular as to the spacing and size of beads than on the opposite side, and the last bead in each row, adjacent to the rhaphe, is enlarged, which is not the case on the opposite side; the central nodule is conspicuous and is unsymmetrically placed nearer to this side, the middle terminations of the rhaphe also being bent toward this side.

Length, 0.141–0.211; width, 0.034–0.045; 8 lines in 0.01 mm.

One is reminded by this species of *N.* (*Alloioneis?*) *kurzii* Grunow (Cleve, W. I. Diat., p. 8, pl. 2, fig. 12). It is not infrequent in several of the Philippine Islands dredgings.

Type.—Cat. No. 43661, U.S.N.M.

NAVICULA SEPARABILIS A. Schmidt

(Schmidt, Atlas, pl. 11, figs. 3–5, 7, 10.)

This is another species common to both Campeche Bay and the Philippine Islands. The claim implied in its specific name is probably justified, although it is rather close to *N. crabro* Ehrenberg.

NAVICULA SERRATULA Grunow

Plate 26, fig. 6

(Schmidt, Atlas, pl. 7, figs. 42–43.)

This is another species peculiar to Campeche Bay and the Philippine Islands, unless the unnamed figure of a Samoa diatom in Schmidt's Atlas, plate 8, figure 11, is this species. Fricke's Index considers it the same, probably correctly so. The Philippine Islands form is here illustrated.

NAVICULA SIMULATOR, new species

Plate 26, fig. 7

Valve nearly flat, very broadly elliptical, with straight sides and rounded ends, densely covered, except in the narrowly elliptical median area that is bisected by the rhaphe, with fine but strongly beaded, closely set lines, a single row of beads to each line, transverse at the middle part of the valve, increasingly diagonal and curved toward each end, until at the extreme ends they become truly longitudinal; the middle area of the valve is narrow, barely elliptical not widened at its center and not tapering; its ends set some distance back from the rounded ends of the valve; the rhaphe bisecting this middle area is heavy, its apical ends forked and turned toward the same side of the valve; the central nodule is slighty dilated; the middle area is, on either side of the rhaphe, marked with very obscurely beaded continuations of the beaded lines covering the outer portions of the valve.

Length, 0.095; width, 0.051; 9 lines in 0.01 mm.

This elegantly sculptured diatom has its nearest affinity in *N. aestiva* Donkin, which, however, has less clearly cut beading than *N.*

smithii Brébisson (Donkin says, "Less granular"), whereas this species is much more sharply cut; *N. aestiva's* rows of beading are less curved as they approach the apices of the valve, and it has a more spindle-shaped median area, the ends of which are not set back from the ends of the valve. (See Donkin, Brit. Diat., p. 6, pl. 1, fig. 13; also Schmidt's questionable figure of *N. fusca* Gregory in Schmidt's Atlas, pl. 7, fig. 4, comparing these with the typical figure of *N. fusca* in Gregory's Diatoms of the Clyde, pl. 9, fig. 15.)

This species is quite rare.

Type.—Cat. No. 43662, U.S.N.M.

NAVICULA SMITHII Brébisson

(Schmidt, Atlas, pl. 7, fig. 19; Van Heurck, Synopsis, pl. 9, fig. 12; Supp., pl. B, fig. 23.)

Next to the figure 8 forms of *Navicula* represented by *N. crabro*, the long elliptical form, of which this species may be taken as the model, is the most frequent shape of marine *Naviculae*, both as to the abundance of individuals and the number of different species. Consequently much confusion exists because of the careless multiplication of new names, and some of the older valid species seem thereby to have lost any satisfactory boundary lines of demarcation. This is particularly true of *N. smithii*, *N. fusca*, *N. elliptica*, etc. A discussion of this subject has already been given under my new species, *N. ingens*.

NAVICULA SPECTABILIS Gregory

Plate 27, figs. 1–2

(Gregory, Diat., Clyde, p. 9, pl. 9, fig. 10; Donkin, Brit. Diat., pl. 2, fig. 5; Schmidt, Atlas, pl. 3, figs. 20–21.)

A Philippine Islands form, not far from the typical one of Gregory's beautiful species, is here illustrated for comparison with some new species which simulate but do not truly agree with it.

NAVICULA SPICULIFERA, new species

Plate 26, fig. 8

Valve flat or barely convex in the middle but strongly convex toward the sides; somewhat spindle-shaped but with very blunt rounded ends; marked with strong, widely spaced and perfectly smooth costae inclined diagonally outward, their inner ends some distance from the rhaphe line; rhaphe strong, flanked by a faint elevated ridge on either side, its median ends well separated, its outer ends some distance back from the convex apices of the valve, and each ending in (or adjacent to) a small spine; the central nodule slightly depressed.

Length, 0.083–0.084; width, 0.021–0.025; 6–6.6 lines in 0.01 mm.

This species is near to Schmidt's Atlas, plate 47, figure 34, incorrectly named *N. impressa* Lagerstedt, and equally incorrectly renamed

N. cancellata Donkin in Fricke's Index. The latter slightly different diatom has its type figure in Donkin, British Diatoms, page 55, plate 8, figure 4. Schmidt's similar figure, however, has moniliform, not smooth, costae.

Type.—Cat. No. 43663, U.S.N.M.

NAVICULA SPLENDIDA Gregory

(Gregory, Glenshira Diat., pl. 5, fig. 14; Schmidt, Atlas, pl. 12. figs. 13–15; pl. 13, figs. 31–34; pl. 69, fig. 22.)

The fine variety figured in Schmidt's Atlas, plate 69, figure 22, is peculiar to Campeche Bay and the Philippine Islands.

NAVICULA SUBACUTA (Ehrenberg) Ralfs

(Schmidt, Atlas, pl. 43, figs. 31–33; Ehrenberg, Mikrogeologie, pl. 35A, sec. 6, fig. 12.)

NAVICULA SUBOSCITANS, new name

(Le Diat., vol. 1, p. 67, pl. 10, fig. 10.)

There named *N.* (*oscitans* var.?) *subundulata* Cleve and Grove; this being preempted in Sylloge Algarum, page 159, for Schmidt's Atlas, plate 49, figure 16, I propose the above name.

NAVICULA SUFFOCATA, new species

Plate 27, fig. 3

Valve somewhat panduriform, deeply indented at the middle, then rapidly broadened to the maximum width, then barely if at all narrowed for one-half the distance to the apices, and finally narrowed rapidly to the rounded ends; markings of narrow costae, the inner end of each slightly enlarged, the outer end terminating in a candle-flame shaped enlargement, in the center of which is a single bead; the costae near the middle of the valve are sharply curved or reflexed backward; in the area of greatest width they are transverse and from there progressively curved forward; the spaces between the costae are heavily rugose or obscurely beaded; a conspicuous hyaline area at each apex and a small rectangular one at the center; rhaphe robust, slightly wider in the central part of each half, bordered on either side by a single row of large beads.

Length, 0.096; width, 0.035; 4.5 lines in 0.01 mm.

Perhaps this should be considered to be a wide variety of *N. adonis* Brun (Diat. Japon, p. 41, pl. 5, fig. 3) found fossil at Jeddo, from which it differs both in outline and in the strongly dotted spaces between the costae, which Brun states are hyaline in his specimens and which are so figured in Schmidt's Atlas, plate 174, figures 18–21.

Type.—Cat. No. 43664 U.S.N.M.

NAVICULA SULCATA Greville

See *Cymatoneis sulcata* (Greville) Cleve.

NAVICULA (DICTYONEIS) THUMII Cleve, misnamed.

(Cleve, Nav. Diat., vol. 1, pl. 5, fig. 33.)

See under *N. marginata* Lewis.

The separation of this form from the many variants of *N. marginata* solely on the ground of its lacking a median constriction would be at least debatable, were there not all possible gradations of this one quality. The extremely constricted type is seen in *N. strangulata* Greville (Micro. Journ., 1866, pl. 12, fig. 24) less sudden in constriction in *N. jamaicensis* Greville (fig. 23 of the same plate) then comes Lewis's type (Schmidt, Atlas, pl. 160, fig. 21, followed by figs 30 and 31 of the same plate), and finally Cleve's figure above. All have the same irregularly set beading, the same rhaphe, the same marginal row of rectangular markings, simulating the marginal chambers of *Mastogloia*, and the same central area. It is one of the most widely distributed and (consequently?) most variable of all the diatoms. Were Cleve's species valid a new specific name would be needed to transfer it into *Navicula* on account of *N. thumii* Pantocsek (Hung. Diat., 1886, vol. 1, pl. 10, fig. 85).

NAVICULA TRANSLUCENS, new species

Plate 26, fig. 9

Valve convex, broadly lanceolate or spindle-shape, with small but rounded apices; markings of very finely beaded, closely set lines running diagonally outward, but less so toward the ends, where they become more nearly transverse, approaching very close to the rhaphe but leaving a thin hyaline median area; at the center this median area is slightly broadened to form the oval hyaline nodule; on either side and parallel with the margin the beading is interrupted by an indistinct line running about midway between the sides and the rhaphe; rhaphe straight, its inner ends joined together by a faint ridge, so that it appears to run continuously across the oval hyaline central nodule; outer ends of the rhaphe not reaching the apices of the valve, very slightly bent at the tips, not terminating in beads.

Length, 0.101–0.135; width, 0.028–0.040; 11–12.5 lines in 0.01 mm.

This delicate species has close affinity with *N. my* Cleve (Nav. Diat., vol. 2, pl. 1, fig. 17) from China and some likeness to *N. belgica* Van Heurck (Belg. Antarct, pl. 1, fig. 9.)

Type.—Cat. No. 43665, U.S.N.M.

NAVICULA TURGESCENS, new name

This is *Diploneis platessa* Cleve and Grove, in Naviculoid Diatoms, volume 1, page 97, plate 2, figure 6. That genus, as elsewhere stated, is not accepted by Van Heurck, Schmidt, De Toni, and others, including the author. But *Navicula platessa* is not available, being preempted by Cleve in his New and Little-Known Diatoms, plate 1, figure 12, necessitating the adoption of a new name for this diatom. One specimen found was strongly suggestive of *N. nitescens* Ralfs, to which indeed the species as a whole bears some resemblance. The type specimen came from Macassar Straits.

NAVICULA VACILLANS A. Schmidt

(Schmidt, Atlas, pl. 8 fig. 61; Van Heurck, Synopsis, pl. 9, fig. 9.)

This rare species has been found also at Ostend, Belgium, and at Cape of Good Hope. Fricke's Index incorrectly includes here Schmidt's Atlas, plate 8, figure 37, and plate 12, figures 42–43, 52–53.

NAVICULA VELATA A. Schmidt

(Schmidt, Atlas, pl. 48, figs. 33–34.)

NAVICULA VENUSTA Janisch

Plate 27, figs. 4–5

(Janisch, Gaz. Exp., pl. 15, fig. 17; Peragallo, Diat., France, pl. 25, figs. 14–15.)

The typical form and an interesting variety of this rare diatom are here figured. Pantocsek subsequently gave this name to a wholly different diatom (Hung. Diat., vol. 2, p. 56, pl. 5, fig. 81). Cleve does not correct this because he transfers the latter to his genus *Caloneis* the validity of which is here denied.

NAVICULA VESPARELLA, new name

Plate 27, fig. 6

This sharply marked species was found by Cleve in material from Java and is named *Diploneis vespa* and figured in Naviculoid Diatoms, volume 1, page 97, plate 2, figure 5. To diatomists who can not find in Cleve's restoration of the Ehrenberg genus *Diploneis* any characteristics which mark off its members from the rest of the *Naviculae*, this would become *N. vespa* (Cleve) but the name is inadmissable because of *N. vespa* (Ehrenberg) Ralfs, as well as of *N. vespa* O'Meara. I have therefore given to it the similar name *vesparella*. One of the Philippine Islands specimens is typical, except that the rhomboidal angles are not so pronounced as in Cleve's specimen, and is much larger 0.090 by 0.024 mm., with 7 lines in 0.01 mm., Cleve's being 0.050 by 0.012 mm., with 11 lines in 0.01 mm. Two other Philippines specimens are exactly like the unnamed figure in Schmidt's Atlas, plate 160, figure 14, from Celebes, which must be considered as being only an unimportant variety of this species and which have measurements that are like Cleve's type, 0.05 by 0.018; with 10 lines in 0.01 mm., and 0.052 by 0.018; with 10.5 lines in 0.01 mm.

NAVICULA VULPECULA A. Schmidt

(Schmidt, Atlas, pl. 12, fig. 56.)

The type came from Celebes Island.

NAVICULA WEISSFLOGII A. Schmidt

Plate 27, fig. 7

(Schmidt, Atlas, pl. 12, figs. 26–32; Van Heurck, Synopsis, Supp., pl. B, fig. 21.)

This species is here represented by a rather wide variety (see my figure), in which the beading is finer and more closely set than in the type. It is probably the same species as *N. diversa* Greville (Diat., So. Pac., pl. 4, fig. 14, 1863) which if so, would replace the above name (1873). Only an examination of Greville's type specimen can determine this, as his figure is manifestly somewhat fanciful. This is another species found in both Campeche Bay and the Philippine Islands.

NAVICULA YARRENSIS Grunow

(Schmidt, Atlas, pl. 46, figs. 1–6.)

This striking species of massive sculpture occurs in a fossil state in Hungary, as well as now living at widely separated localities, United States Atlantic Seaboard, Samoa, Kiel, Germany, and the Philippine Islands.

NAVICULA ZOSTERETI Grunow

(Grunow , N. Ung. Gek. Diat., pl. 2, fig. 23; Schmidt, Atlas, pl. 47, figs. 42–44.)

Genus NITZSCHIA Hassall

NITZSCHIA ALATA Leuduger-Fortmorel

See *N. campechiana* Grunow.

NITZSCHIA BISCULPTA, new species

Plate 28, figs. 1–2

Valve broadly elliptical, slightly constricted at the middle, with rather acute, wedge-shaped ends; finely marked with close beading arranged in quincunx lines, the sculpturing being bisected longitudinally by a narrow ragged, median, hyaline line, slightly curved, toward the dorsal side; the half on the ventral side of this line is further marked by a prominent overlay of short, more or less vermiform shining dashes; wanting on the dorsal half; costal band on the dorsal margin small and finely cross-barred, interrupted by a nodule in the sinus of the median constriction.

Length, 0.133–0.170; width, 0-050–0.062; decussating lines, 12–13 in 0.01 mm.; costae of dorsal band, 5.5–6 in 0.01 mm.

This curiously marked diatom, belonging to the *N. panduriformis* group, is rather abundant in the Philippine Islands. I have found it also at Hilo, Hawian Islands. It bears a slight resemblance to *N. nicobarica* Grunow.

Type.—Cat. No. 43666, U.S.N.M.

NITZSCHIA CAMPECHIANA Grunow

Plate 28, figs. 3–4

(Grunow, New Species, Nitz. Micro. Journ., 1880, p. 395, pl. 13, fig. 16.)

This is identical with *N. alata* Leuduger-Fortmorel (Diat. Malaisie, p. 24, pl. 2, fig. 11, 1892). It is quite probable that *N. superba* Leuduger-Fortmorel (Diat. Ceyl., p. 40, pl. 8, fig. 83, 1879) is also the same, although the double row of unskillfully formed beads at the middle of the valves, found in *N. campechiana* and *N. alata*, is lacking in *N. superba*, and the ends are slightly more pointed. All are abundant in the Philippine Islands; and a series of many intermediate forms goes far to prove that the above-mentioned marks of distinction vary individual cases in every conceivable way. I have, at least temporarily, held *N. superba* separate, as thereby simplifying idenification; but a specific difference will probably eventually be found untenable. In that case, the oldest name, *N. superba*, would replace *N. campechiana* and *N. alata*. The similar *N. bukensis* Peragallo (Diat., Samoa, pl. 2, fig. 6, 1911) should also be mentioned here as an important variety of *N. superba*. Of course, all of these may be said to belong to the *N. nicobarica* Grunow group of *Nitzchiae*. (See this in Reise F. Nov., pl. 1A, fig. 4.)

As the name indicates, this is another species found in Campeche Bay and the Philippine Islands.

NITZSCHIA COCCONEIFORMIS Grunow

Plate 28, fig. 5.

(Grunow, New Species, Nitz., p. 395, pl. 12, fig. 5; Peragallo, Diat., France, pl. 75, fig. 15.)

Both the type form and an interesting variety of this rare diatom were found, the latter figured here.

NITZSCHIA DISTANS Gregory

(Geogory, Diat., Clyde, p. 58, pl. 14, fig. 103; Van Heurck, Synopsis, pl. 62, fig. 10.)

Both the type form and the curious variety which Grunow calls var. *tumescens* were found, the latter being another example of diatoms common to the floras of Campeche Bay and the Philippine Islands.

NITZSCHIA FLUMINENSIS Grunow

(Grunow Oest. Diat., Wien. Verh., 1862, p. 581, pl. 12, fig. 35; Van Heurck Synopsis, pl. 62, figs. 3–4.)

Here is included Grunow's *N. majuscula*, which Van Heurck rightly considers to be a variety of this species; figured in Van Heurck, Synopsis, plate 62, figure 5. The type is found in both Campeche Bay and the Philippine Islands, var. *majuscula* in only these two places.

NITZSCHIA GRAEFFEI Grunow

(Cleve, W. I. Diat., p. 20, pl. 5, fig. 32; Grunow, New Species, Nitz., pl. 12, fig. 4.)

NITZSCHIA GRANULATA Grunow

(Cleve and Grunow, Arct. Diat., p. 68; Grunow, New Species, Nitz., pl. 12, fig. 7; Van Heurck, Synopsis, pl. 57, fig. 5.)

NITZSCHA INSIGNIS Gregory

Plate 28, fig. 6

(Gregory, Glenshira Diat., pl. 1, fig. 46; Peragallo, Diat., France, pl. 75, fig. 5.)

The type form and several varieties were found, one of which is here figured.

NITZSCHIA LITTORALIS Grunow

(Van Heurck, Synopsis, pl. 59, figs. 1–3; Peragallo, Diat., France, pl. 69, fig. 17.)

The form common in the Philippine Islands is exactly that figured in Van Heurck's Synopsis, plate 59, figure 1.

NITZSCHIA MAJUSCULA Grunow

See under *N. fluminensis* Grunow.

NITZSCHIA MARGINULATA Grunow

(Cleve and Grunow, Arct. Diat., p. 72, pl. 5, fig. 93; Van Heurck, Synopsis, pl. 58, figs. 12–14; Peragallo, Diat., France, pl. 70, figs. 14–17.)

It is noteworthy that the form prevalent in the Philippine Islands is the one common also in Campeche Bay, namely, *N. marginulata*, var. *subconstricta* Grunow, it being another example of the similarity of these two floras; it is figure 12 above.

NITZSCHIA OBESA Castracane

(Castracane, Chall. Exp., p. 67, pl. 13, fig. 11.)

I greatly question there being any essential difference between this and Leuduger-Fortmorel's previously named *N. granulosa* (Diat. Ceyl., pl. 3, fig. 37). Coming from approximately the same part of the world, the figures and discriptions of the two are remarkably alike. Castracane does not give the dimensions of his species, but says it is twice as long as broad. The measurements by Leuduger-Fortmorel agree, namely, 104 by 48. *N. obesa* is said to have fine decussating rows of beading, and although a decussating order is not evident in the figure of *N. granulosa* it must be discoverable in so evenly and closely set beading as there indicated. Castracane's type came from the Philippine Islands and I give his name, with the above statement that it is probably identical with the Ceylan Island form.

NITZSCHIA PANDURIFORMIS Gregory

(Gregory, Diat., Clyde, p. 57, pl. 14, fig. 102; Van Heurck, Synopsis, pl. 58, figs. 1–3.)

NITZSCHIA PULCHERRIMA Kitton

(Micro. Journ., 1874, pl. 81, figs. 1–3; Peragallo, Diat., France, pl. 76, fig. 2.)

This is another species common to both Campeche Bay and the Philippine Islands.

NITZSCHIA SPATHULATA Brébisson

(Smith, Brit. Diat., pl. 31, fig. 268; Van Heurck, Synopsis, pl. 62, figs. 7–8; H. L. Smith, Types, No. 370.)

NITZSCHIA SUPERBA Leuduger-Fortmorel

(Leuduger-Fortmorel, Diat., Ceyl., p. 40, pl. 8, fig. 83.)

For discussion of the probable identity of this and *N. campechiana* Grunow, see the latter. Typical specimens of *N. superba* were found.

NITZSCHIA TRYBLIONELLA Hantzsch

(Peragallo, Diat., France, pl. 69, figs. 11–13; Van Heurck, Synopsis, pl. 59, fig. 6.)

This minute variety of the type form is put as a separate species, *N. salinarum* Grunow, in the above reference to Van Heurck's Synopsis. It is better to retain Grunow's original idea of making it a variety of *N. tryblionella.* (See Cleve and Grunow, Arct. Diat., p. 70.)

NITZSCHIA TUBICOLA Grunow

(Van Heurck, Synopsis, pl. 69, fig.14.)

Unquestionable examples of this rare diatom were found, which, so far as I know, has been previously reported only from Sonderberg (Denmark), occurring there "in the tubes of *Navicula grevillei.*"

NITZSCHIA VALIDA Cleve and Grunow

(Cleve, W. I. Diat., pl. 3, fig. 19; Van Heurck, Synopsis, pl. 65, fig. 4.)

This is another species common to both Campeche Bay and the Philippine Islands.

NITZSCHIA VERMICULATA Castracane

(Castracane, Chall. Exp., p. 68, pl. 13, fig. 12.)

It differs from *N. superba* Leuduger-Fortmorel (Diat., Ceyl., pl. 13, fig. 16) almost wholly in the peculiar vermiculate arrangement of the beading. Perhaps only a Philippine Islands variety of that species, Castracane's type having been found at Zebu.

NITZSCHIA WEISSFLOGII Grunow

(Peragallo, Diat., France, pl. 76, figs. 3–4.)

This species also is limited to Campeche Bay and the Philippine Islands.

NITZSCHIA ZEBUANA, new species

Plate 28, fig. 7

Valve linear, with rounded ends; median indentation barely evident; very delicate transverse lines along both dorsal and ventral sides; the the median portion, about one-third the width of valve, hyaline or very faintly lined; dorsal band very narrow and marked with fine, distant crosslines.

Length, 0.139; width, 0.015; fine lines, 27 in 0.01; coarse dorsal lines 10–11 in 1.01 mm.

It is possible this may be related to *N. plana*, var. *zebuana* Castracane (Chall. Exp., p. 67, pl. 13, fig. 10) the measurements and fineness of markings of which are not given. At any rate, that form is too wide from *N. plana* W. Smith to be accepted as a varity. (See Smith, Brit. Diat., vol. 1, p. 42, pl. 15, fig. 114.)

Type.—Cat. No. 43667, U.S.N.M.

Genus OMPHALOPSIS Greville

OMPHALOPSIS AUSTRALIS Greville

(Greville, Diat., So. Pac., p. 537, pl. 1, figs. 10–11; Van Heurck, Treat., p. 335, fig. 92.)

This rare diatom has been previously found only in the Seychelles Island and Woodlark Island, new Guiana. The genus is closely allied to *Plagiogramma.*

Genus PLAGIOGRAMMA Greville

PLAGIOGRAMMA ANTILLARUM Cleve

Plate 29, fig. 1

(Cleve, Diat. W. I., pl. 3, fig. 16; not Schmidt, Atlas, pl. 209, fig. 10.)

Schmidt's figure above should not be referred to this species. A somewhat finer beaded variety of *P. antillarum* is named *P. truanii* Pantocsek (Hung. Diat., vol. 3, pl. 15, fig. 224.)

PLAGIOGRAMMA APPROXIMATUM A. Schmidt

See under *P. polygibbum* Cleve and Grove.

PLAGIOGRAMMA ATTENUATUM Cleve

Plate 29, fig. 2

(Cleve, W. I. Diat., p. 10, pl. 3, fig. 18.)

This rare diatom was found in the nearby island of Ceylon and the type in St. Bartholomew, W. I. It is here illustrated, as the original figure by Cleve is poor.

PLAGIOGRAMMA DISTINCTUM, new species

Plate 29, fig. 3

Valve narrow spindle-shaped, distended at the middle; the central space is a narrow, tranverse, hyaline rectangle, heavily outlined; the two terminal spaces are thimble-shaped, heavily outlined, faintly dotted; exclusive of these three spaces, the valve is covered on either side with diagonal rows of beads, the spaces between being wider than the rows; the beading of the sides appoach inwardly, but leave an evident median longitudinal line (pseudorhaphe).

Length, 0.208; width, 0.040; 2.6 lines in 0.01 mm.

This diatom might be looked upon as a not at all obese variety of *P. obesum* Greville as figured in the Quarterly Journal of Microscopical Science for 1859, plate 10, figure 12, except that the beading on Greville's species is in strictly transverse, not diagonal, rows which are not widely separated, as they are in the above. Its nearest relative is, however, *P. constrictum* Greville (So. Pac. Diat., pl. 1, fig. 8), especially as figured Schmidt's Atlas, plate 211, figure 10, from Cebu, in which the diagonal and wider spaced rows of beads are closely similar. The absence of any constriction should probably justify their separation. Compare also the incorrectly named *P. gregorianum*, var. *robusta* Brun in Diatomees Japon, plate 9, figure 7.

Type.—Cat. No. 43668, U.S.N.M.

PLAGIOGRAMMA GREGORIANUM Greville

(Micro. Journ., 1859, pl. 10, fig. 1; Van Heurck, Synopsis, pl. 36, fig. 2.)

It is not well to disturb this well-known name for the uncertain identity of it with *Denticula staurophora* Gregory (Diatoms of the Clyde, p. 497, pl. 10, fig. 37).

PLAGIOGRAMMA NANKOORENSE Grunow

(Grunow, Reise F. Novara, p. 95, pl. 1A, fig. 8; Schmidt, Atlas, pl. 210, fig. 31.)

Castracane names this *Glyphodesmis challengerensis* in his Report of the Challenger Expedition, plate 18, figure 13, and in Leuduger-Fortmorel's Diatomees Ceylan, plate 5, figure 59, it is called *P. ceylanense* Leuduger-Fortmorel.

PLAGIOGRAMMA OBESUM Greville?

See remarks under *P. distinctum*, new species.

PLAGIOGRAMMA PAPILIO Cleve and Grove

(Le Diat., vol. 1, pl. 8, fig. 17; Schmidt, Atlas, pl. 211, fig. 13.)

This and *P. Atomus* Greville are closely alike. The type specimen came from the near-by Macassar Straits.

PLAGIOGRAMMA POLYGIBBUM Cleve and Grove

(Le Diat., vol. 1, pl. 8, figs. 7–11; Schmidt, Atlas, pl. 211, figs. 2–5.)

Here also belong *P. quadrigibbum* Brun (Schmidt, Atlas, pl. 211, fig. 1) and *P. approximatum* A. Schmidt (Schmidt, Atlas, pl. 211, fig. 7).

PLAGIOGRAMMA SULCATUM Cleve and Grove

(Le Diat., vol. 1, pl. 8, figs. 1–3; Schmidt, Atlas, pl. 210, fig. 5.)

This departs so widely from other species of *Plagiogramma* as to awaken doubt of its belonging here.

PLAGIOGRAMMA TESSELATUM Greville

(Micro. Journ., 1859, pl. 10, fig. 7; Schmidt, Atlas, pl. 209, figs. 42–50.)

Castracane's *Glyphodesmis murrayana* (Chall. Exp., pl. 18, fig. 12) belongs here.

Genus PLEUROSIGMA W. Smith

This genus stands out with unusually sharp distinctness, if we include in it *Donkinia* Ralfs, *Rhoicosigma* Grunow, and *Toxonidia* Donkin, which in fact are nothing more than subgeneric divisions of *Pleurosigma*, but are accorded generic rank to facilitate identification. All are characterized by a more of less sigmoid outline, both as to the contour of the valve and the shape of the rhaphe; and all are strikingly alike in the simplicity and elegance of marking that covers the entire valve—a delicate network of closely appressed beading, arranged in one of three ways—in transverse and longitudinl rows, in decussating rows of three directions, with a divergence of approximately 60°, one being transverse and the other two oblique, and thirdly, in oblique rows of two directions with a divergence of approximately 90°, there being no transverse arrangement of rows. This last has not been recorded; but a careful inspection of some species grouped with the three-row decussating type shows that the angle between the lines is 90° with no trace of a transverse arrangement. A notable example of this is *P. japonicum* Castracane, in the Report of the Challenger Expedition, page 38, plate 29, figure 14, correctly illustrated as having only two sets of lines, though the fact is not commented upon. This species is recorded below, being not uncommon in the Philippine Islands, and invariably shows only two rows by oblique as well as by direct lighting. The same is true of my new species *P. obesum*, under which is discussed the reason for the disappearance of the third line. The attempt to divide *Pleurosigma* proper into two genera—*Pleurosigma* for species with decussating rows of three directions and *Gyrosigma* for species with two direction lines, transverse and longitudinal—has nothing to comment it. Not only would it necessitate a third genus to accommodate those forms above mentioned, which have neither of these arrangements of beading, but to be consistent, it would require the subdivision of both *Donkinia* and *Rhoicosigma* into two genera each, as both contain species with transverse-longitudinal lines as well as other species with three direction decussating lines. Although, as above mentioned, this genus stands out sharply defined, the simple and unique uniformity of its structure renders clear-cut demarcation between its species a difficult thing. For we are confined to only three factors for our specific marks of distinction—size, a very unstable and misleading quality; difference in contour, as relative width, sharpness or bluntness of apices, etc.; and lastly, fineness or coarseness of marking. In consequence of this, species have been unduly multiplied, and, on the other hand, cautious students have grouped with known species some new forms that should be held specifically distinct. In short, *Pleurosigma* in its species represents one of the most difficult subjects in diatom taxonomy. One has, so to speak, to sense the species as one recognizes individuals among our fellow men. Some distinctions are of course easily made; one can say at a glance that *P. formosum* W. Smith is not *P. angulatum* W. Smith, that *P. balticum* W. Smith is not *P. littorale* W. Smith. But many cases of classification in Peragallo's admirable monograph on this genus will continue to be approved or rejected by different investigators. The several new species here described and figured will appear to some as unimportant phases of some already established. But in no case has a new species been created here without careful study and an effort to assign it to an existing one.

PLEUROSIGMA ACUS, new species

Plate 29, figs. 4–5

Valve very narrow lanceolate, straight; ends sharp; markings quincunx, tranverse lines obscure; terminal beads of rhaphe prominent; hyaline space around central nodule small.

Length 0.162–0.258; width 0.012–0.022; 13.5–13.8 lines in 0.01 mm.

P. acus has close affinity with *P. intermedium* W. Smith, not so much with the typical form as given in Smith's British Diatoms, page 64, plate 21, figure 200, in Van Heurck's Synopsis, plate 18, figure 6, in H. L. Smith's Types No. 405 (itself an English sample), etc., as in certain perhaps permissible variations, notably, plate 5, figure 27, in Peragallo's Monographie du genre *Pleurosigma*. But *P. acus*, though a much smaller diatom, averaging 0.170 by 0.016 mm., as against 0.370 by 0.021 mm., is relatively much more coarsely marked, 13.5–13.8 lines as against 22 lines in 0.01 mm., and the two oblique lines are so nearly at right angles, instead of at 60°, that the transverse lines are barely discoverable. Abundant specimens having supplied an opportunity for repeated comparisons between this and *P. intermedium* I do not hesitate to class it as a new species. All my Philippine specimens are from Jolo Jolo, Sulu Islands; but I have found it also at Puna, Hawaii, the Hawaiian specimens being relatively narrower, as their ratio of length to width is sometimes as high as 17 to 1.

Type.—Cat. No. 43669 U.S.N.M.

PLEUROSIGMA AFFINE Grunow

(Van Heurck, Synopsis, pl. 18, fig. 9; Peragallo, Pleuro, pl. 4, figs. 2, 3, 5, 8.)

Neither Ralf's *P. normanii* nor H. L. Smith's *P. virginicum* should be included here, although so grouped by Peragallo.

PLEUROSIGMA ANGULATUM W. Smith

(Smith, Brit. Diat., pl. 21, fig. 205; Peragallo, Pleuro., pl. 5, figs. 3–5; H. L. Smith, Types, Nos. 389–390.)

De Toni (Syl. Alg., pp. 231–234) has attempted an impossible condensation of species under this head. Peragallo, with some reason, expresses doubt of the general custom of considering *P. quadratum* as a variety of *P. angulatum.*

PLEUROSIGMA BALTICUM (Ehrenberg) W. Smith

(Smith, Brit. Diat., pl. 22, fig. 207; H. L. Smith, Types, No. 396; Peragallo, Pleuro., pl. 7, figs. 19–20.)

PLEUROSIGMA DOLOSUM, new species

Plate 29, fig. 6

Valve narrow elliptical, not sigmoid, ends not produced, blunt, rounded; markings quincunx; rhaphe straight, outer ends beaded, reaching to the margin; central area small, oval not laterally extended.

Length 0.083; width 0.015; 25 lines in 0.01 mm.

Jolo Jolo, Sulu Islands; rare.

This very divergent species of the true *Pleurosigmae* differs from others only in its Naviculoid form. Under low magnification it might easily be overlooked as a rather minute specimen of *Navicula iridis* Ehrenberg. But its rhaphe, central area, and delicate, uniform quincunx marking fix clearly its generic character.

Type.—Cat. No. 43670, U.S.N.M.

PLEUROSIGMA ELEGANTISSIMUM Castracane

(Castracane, Chall. Exp., p. 37, pl. 28, fig. 1; Peragallo, Pleuro., pl. 5, fig. 23.)

A slightly doubtful specimen of this diatom was found; the original was from Yeddo Bay, Japan. The uncertainty comes from Castracane saying that his species has extremely delicate striae, "striis delicatissimis"; but as no measurements of these are given the exact meaning of the expression can not be determined. The peculiar shape and the eccentric rhaphe indicate that the Philippine specimens and the above are the same.

PLEUROSIGMA ELONGATUM W. Smith

(Smith, Brit. Diat., pl. 20, fig. 199; Van Heurck, Synopsis, pl. 18, fig. 7; Peragallo, Pleuro., pl. 3, figs. 5, 7.)

This is one of several species which De Toni (Syl. Alg., p. 233) unwisely huddles together under *P. angulatum.*

PLEUROSIGMA EXEMPTUM, new species

Plate 29, fig. 7–8

Valve broadly lanceolate, moderately sigmoid, tapering from the broad middle portion to the somewhat blunt ends; rhaphe more sigmoid than the valve, thereby approaching opposite sides toward the ends; a slight lateral hyaline dilation around the central nodule; markings quincunx, but unusually arranged, in that the customary transverse lines are lacking, and are replaced by faint longitudinal lines. This is due to the angle between the oblique lines being not the normal 60° but slightly in excess of 90°, so that the beading becomes so spaced that longitudinal lines appear bisecting the obtuse angle.

Length 0.504–1.16; with 0.09–0.116; lines 10.3–11 in 0.01 mm.

Although the color of specimens is a very untrustworthy specific character, the almost uniformly heavy coloration of this species is noteworthy. Specimens are very conspicuous not only by reason of their great size but because they are a dark greenish-brown with a strong metallic luster.

Rather plentiful in most of the Philippine Islands gatherings and especially so in one from Jolo Jolo, Sulu Islands.

Type.—Cat. No. 43671, U.S.N.M.

PLEUROSIGMA FALX, new species

Plate 30, fig. 1)

Valve lanceolate, sigmoid, tapering to the narrow but not acute ends; rhaphe more sigmoid than the valve, being plainly oblique to its long axis at the middle, but approaching only slightly the opposite sides of the valve toward the two ends; a small lozenge-shaped central area; markings coarse, rigidly quincunx, the angles between the six lines from any given point being 60°. The valves are unusually robust and thick walled, so that the outline appears as a heavy dark line.

Length, 0.119; width, 0.0194; 15 diagonal lines in 0.01 mm.

There is some resemblance between this relatively coarsely marked species and small specimens of *P. decorum* W. Smith, except for the much more sicklelike swing of the latter and the nearer approach of its very sigmoid rhaphe to the sides of the valve. This species is plentiful in some Philippine Islands material and it occurs occasionally in Galapagos Islands dredgings.

Type.—Cat. No. 43672, U.S.N.M.

PLEUROSIGMA FORMOSUM W. Smith

(Smith, Brit. Diat., pl. 20, fig. 195; Peragallo, Pleuro., pl. 1, fig. 1; H. L. Smith, Types, No. 694.)

Peragallo's figures of this fine species are all defective in outline. He designates his plate 1, figure 4, as the true type, which is far from the case, as can be seen by comparison with W. Smith's original figure. The nearest to this in Peragallo's monograph is his plate 1, figure 1.

PLEUROSIGMA HAMULIFERUM Brun

(Brun, Diat. Jap., pl. 9, fig. 5; Peragallo, Pleuro., pl. 5, fig. 31; also pl. 4, fig. 12, misnamed.)

This species with the curiously hooked rhaphe was first found in the fossil deposit at Sendai, Japan; but recent specimens were subsequently found in Yokohama Bay, Japan, and now in the Philippine Islands.

PLEUROSIGMA HEROS Cleve

(Cleve, Nav. Diat., vol. 1, p. 44, pl. 4, fig. 20.)

Previously found only at Macassar Straits.

PLEUROSIGMA ITALICUM Peragallo

(Peragallo, Pleuro., p. 8, pl. 3, fig. 10.)

The similarity of this species, hitherto found only at Naples, Italy, is so close to *P. marinum* Donkin that its independence is to be questioned.

PLEUROSIGMA JAPONICUM Castracane

(Castracane, Chall., Exp., p. 38, pl. 29, fig. 14.)

The unquestionable two-line oblique marking of this species has been noted in the discussion of this genus and its subdivisions.

PLEUROSIGMA LANCEOLATUM Donkin

(Micro. Journ., 1858, pl. 3, fig. 4; not Peragallo, Pleuro., pl. 5, fig. 14.)

Roper's *P. transversale* in the Quarterly Journal of Microscopical Science for 1858, plate 3, figure 11, is practically the same. As noted above, Peragallo's figure does not represent this diatom.

PLEUROSIGMA LATUM Cleve

(Cleve and Grunow, Arct. Diat., pl. 3, fig. 68; Peragallo, Pleuro., pl. 3, figs. 16–18.)

PLEUROSIGMA NAVICULACEUM Brébisson

(Brébisson, Diat., Cherb., pl. 1, fig. 7; Peragallo, Pleuro., pl. 4, figs. 19–22.)

PLEUROSIGMA NICOBARICUM Grunow

(Grunow, Reise F. Nov., p. 101, pl. 1A, fig. 20; Peragallo, Pleuro., pl. 4, fig. 9 (not pl. 4, figs. 10–12).)

The figures of Peragallo excluded above have no relation to this species. His No. 12, and perhaps No. 11, is *P. hamuliferum* Brun.

PLEUROSIGMA NORMANII Ralfs

(Peragallo, Pleuro., pl. 4, fig. 6; Cleve and Grunow, Arct. Diat., pl. 3, fig. 67.)

A specimen found by Mr. E. Leonard, Liverpool, England, in Philippine Islands material supplied by me, agrees more closely with Peragallo's figure than with that in Cleve and Grunow's Arctic Diatoms. The union of this species with *P. affine* Grunow is questionable. Peragallo makes it a variety of the latter, while Cleve (Nav. Diat., vol. 1, p. 40) puts *P. affine* (1880) in *P. normanii* (1861).

PLEUROSIGMA OBESUM, new species

Plate 29, fig. 9

Valve broad, sigmoid, tapering to the rather blunt rounded ends, the curve of one side from middle to end being strongly convex, that of the opposite side barely concave; rhaphe strongly oblique to the long axis at the middle of the valve, but running perfectly straight for half the distance to the ends, then curving strongly as it approaches the convex side from which it barely remains separated; terminal and middle ends of rhaphe beaded, the former not quite reaching the ends of the valve; central area expanded into a small transverse oval; markings oblique to the long axis, but crossing each other at right angles, so that no transverse or longitudinal lines are present.

Length, 0.312–0.351; width, 0.063–0.067; 11.2 lines in 0.01 mm.

There is a rather close resemblance between this species and *P. heros* Cleve (Nav. Diat., vol. 1, p. 44, pl. 4, fig. 20), but the markings of the latter are finer, its shape is relatively less obese, and its rhaphe is parallel with the long axis at the middle of the valve instead of strongly oblique to it.

In connection with the markings of this species it is in place to say that the generally accepted custom of dividing this genus into two groups, first, those with quincunx markings—that is, one set of lines transverse and the other two oblique—and, second, those with rectangular lines, one set transverse and the other longitudinal, is not correct. As stated in the discussion of the genus, one other pattern is more or less prevalent, namely, species having two sets of rectangular lines, not transverse and longitudinal, but both equally oblique to the long axis of the valve. In the truly quincunx forms, like *P. angulatum* W. Smith, *P. robustum* W. Smith and the next species *P. obtusum*, new species, the lines radiating from any given point are six in number, and the six angles between them are theoretically 60°; but in the above diatom there are but two sets of lines; that is, four radiating from any given point, and the angles between them are all 90°. The most conspicuous example of this arrangement is *P. japonicum* Castracane in his Report of the Challenger Expedition, plate 29, figure 14, which occurs abundantly in the Philippine Islands. Not only does Castracane correctly figure this with only two sets of lines, both oblique, but Peragallo in his Monographie du genre Pleurosigma, plate 3, figure 15, adds a question to the drawing of the transverse lines. The present species is equally destitute of transverse lines and its two oblique sets of lines are at 90° to each other. An even further departure from the normal quincunx marking is found in my *P. exemptum* (q. v.) where the upper and under angles between the oblique lines are actually in excess of 90°, so that a faint suggestion of a third set of lines, not transverse but longitudinal, is discoverable. It is evident that beads arranged in strictly transverse and longitudinal rows will give rise to only two sets of lines, which will stand at right angles to each other; that a strictly quincunx order will exist only when the three sets of lines subtend angles of 60° between each other, and that when the angle between the two sets of lines becomes greater than 90° a third set of lines will begin to appear as bisecting this wider angle. In the typical *P. angulatum* the upper and under angles between the two oblique lines is sometimes a trifle less than 60° and the four side-angles proportionally more than 60°, with the result that the transverse lines are then more easily seen than the oblique ones.

Type.—Cat. No. 43673, U.S.N.M.

PLEUROSIGMA OBTUSUM, new species

Plate 30, figs. 2–3

Valve slightly sigmoid and only slightly tapering, with broad, blunt, rounded ends; markings strictly quincunx, so that the two oblique and the transverse lines are equally visible and subtend angles of 60°; rhaphe at the middle oblique to the long axis, at first barely, then more rapidly curved as it approaches the ends, where it is sharply curved, and approaches close to the more sigmoid side of the valve.

Length, 0.126; width, 0.029; 14–15 lines in 0.01 mm.

This species stands nearest to my *P. prisma* (q. v.). Rare.

Type.—Cat. No. 43674, U.S.N.M.

PLEUROSIGMA PRISMA, new species

Plate 30, fig. 4

Valve broad prismatic, only slightly sigmoid in outline, with very blunt, rounded ends; rhaphe slightly oblique to the long axis at the middle of the valve, perfectly straight until near the apices, then strongly curved, its apical beads elongated and close to the blunt ends, its central beads well separated; a relatively large transversely widened hyaline central area; markings quincunx, the diagonal lines more evident than the transverse.

Length, 0.129–0.130; width, 0.031–0.035; 13 lines in 0.01 mm.

This is one of the most heavily built and coarsely marked of the quincunx *Pleurosigmae*.

Type.—Cat. No. 43675, U.S.N.M.

PLEUROSIGMA RHOMBEUM Grunow

(Peragallo, Pleuro., pl. 3, figs. 13–14.)

Found previously at Samoa and at Auckland, New Zealand.

PLEUROSIGMA RIGENS, new species

Plate 30, fig. 5

Valve prismatic or spindle-shape, with straight sides, not sigmoid except that the blunt ends tend very slightly to opposite sides and the rhaphe somewhat more so; the valve narrows from middle to near the ends, then the sides become parallel; markings quincunx, the angle between the oblique lines a trifle less than 60°, so that the transverse lines are more prominent than the oblique; rhaphe perpendicular to transverse axis at the middle; the central area expanded laterally into a small oval; markings about this area invariably rugose because of irregularly spattered blotches somewhat larger than the beading, so that the center of the valve always appears to be dirty.

Length, 0.094–0.127; width, 0.020–0.022; 16–17 oblique lines in 0.01 mm., 15 transverse lines in 0.01 mm.

Although this might be classified as a wide variety of *P. rigidum* W. Smith, I suggest a new name, because I find it to be very uniform in its much smaller size and its relatively coarser markings than that species. It is abundant in most of the Philippine Islands dredgings, including the Sulu group, and is at times associated with *P. rigidum*, from which it is readily distinguished by its deep brown color, its minuteness, and the blotched appearance of the valve around the central nodule. The known measurements of *P. rigidum* are length 0.30–0.44; width 0.04–0.068; 18–20 oblique lines, 17–19 transverse lines in 0.01 mm., which contrast strongly with those of this species.

Type.—Cat. No. 43676, U.S.N.M.

PLEUROSIGMA RIGIDUM W. Smith

(Smith, Brit. Diat., pl. 20, fig. 198; H. L. Smith, Types, No. 410; Peragallo Pleuro., pl. 6, figs. 3–6.)

Rather abundant and showing several variations from the type.

PLEUROSIGMA SIMILE Grunow

(Peragallo, Pleuro., pl. 7, fig. 27.)

The suggestion of Peragallo that this may be a variety of *P. balticum* W. Smith can not be commended.

PLEUROSIGMA STRIGOSUM W. Smith

(Smith, Brit. Diat., pl. 21, fig. 203; H. L. Smith, Types, No. 414; not Peragallo, Pleuro., 5, figs. 1–2.)

There is not satisfactory ground for De Toni's uniting this with *P. angulatum.* H. L. Smith's Types, No. 414, is made of material from England, and exhibits on the same slide truly typical specimens of both species. Their points of dissimilarity are easily seen, and William Smith seems to have been warranted in considering the two to be separate species. The two figures in Peragallo's Monographie du genre Pleurosigma are very misleading.

PLEUROSIGMA SUBRIGIDUM Grunow

(Peragallo, Pleuro., pl. 2, fig. 3.)

PLEUROSIGMA SULUENSE, new species

Plate 30, fig. 6

Valve barely sigmoid, and only so toward the ends, one side of each half almost straight at the middle and progressively curving toward the end, the other side straight and becoming slighty concave toward the end; rhaphe straight until nearing the ends it approaches the concave side, at the middle almost at right angles to the tranverse axis, hooked at its outer ends and without beads at the middle, the two halves being joined around one side of the central nodule; central area slightly dilated transversely; markings uniform over the entire valve, consisting of two sets of oblique lines at an angle of so nearly 90° that no transverse lines are visible, even by oblique light.

Length 0.529; width, 0.062; 11–11.2 in lines, 0.01 mm.

So far as the outline is concerned, this diatom is hardly separable from some other species. It very closely resembles the general build of *P. majus* Grunow (Cleve, Nav. Diat., vol. 1, p. 44, pl. 4, fig. 15), the markings of which are radically different. It is near to what Peragallo, in his Monographie du genre Pleurosigma, plate 2, figure 7, calls *P. decorum* W. Smith, but which does not remotely resemble that species either in form or in marking. (See Smith, Brit. Diat., pl. 21, fig. 196; H. L. Smith, Types, No. 694; Van Heurck, Synopsis, pl. 19, fig.1, etc.) Diatom literature also contains figures named *P. speciosum* W. Smith and others *P. strigosum* W. Smith, which seem to approach closely to the present species; but the typical forms do not at all correspond. In both those species, which are only half or less the size of the present one, the markings are relatively much finer. Thus the average for *P. strigosum* is length 0.007–0.011 inch, with 44 lines in 0.001 inch; while *P. suluense* is length 0.0208 inch, with 27 lines in 0.001 inch. In fact this is a case in which only the comparison of actual specimens of different species will clearly reveal those adequate specific differences which verbal discriptions and photographs merely suggest.

Type.—Cat. No. 43677, U.S.N.M.

Genus PODOCYSTIS Kützing

PODOCYSTIS SPATHULATA (Shadbolt) Van Heurck

(Van Heurck, Treat., p. 365; Peragallo, Diat., France, p. 261, pl. 68, fig. 12.)

The two above citations taken together go far toward clearing up a confusion of long standing regarding the two species of *Podocystis*—the one here recorded and *P. adriatica* Kützing. De Toni and others (Syl. Alg., p. 601) consider these and Bailey's *P. americana* to be *P. adriatica;* but as Van Heurck points out, that species is sharply distinct from Shadbolt's *Euphyllodium spathulatum* as figured in the Microscopical Journal for 1854, plate 1, figure 3, and excellently reproduced in the above citation in Peragallo's Diatomées de la France, where it is shown in contrast with the typical *P. adriatica* (fig. 11). This last has double or threefold rows of fine beading, the rows separated by costal lines; while the present species has single rows of coarse rectangular beading without separating costal lines. There is also in this species (not always, as Van Heurck implies, but very often) a heavy network of anastomosing costal bars which does not in reality belong to the surface of the valve but lies beneath the beading as a sort of craticular plate. *P. spathulata* is generally balloon shaped; and as the American species of *P. adriatica* are also balloon shaped, instead of cuneate like Kützing's type, Bailey considered he had a new species and called it *P. americana.* (New Sp. and Loc. Diat., pl. 1, fig. 38.) But his exceptionally good figure shows it to have the two to three rows of fine beading separated by costal lines of *P. adriatica.* H. L. Smith's Type, No. 418, the American form, also is conclusive as to this marking. A third name—*P. australica* Witt (figured in his Diatomaceen Südsee, Journ. Mus. Godeff., 1873, p. 70, pl. 8, fig. 10)—is evidently the same as Bailey's form. We have therefore at present two species, *P. spathulata* (Shadbolt) Van Heurck, and *P. adriatica* Kützing, including Bailey's American variety of this, resembling only in contour the other species.

Genus PORPEIA Bailey

PORPEIA QUADRICEPS Bailey

(Pritchard, Inf., pl. 6, fig. 6; Greville, New and Rare Diat., pl. 6, figs. 18–19; Schmidt, Atlas, pl. 142, figs. 46–56.)

Genus PSEUDO-EUNOTIA Grunow

PSEUDO-EUNOTIA DOLIOLUS (Wallich) Grunow

Plate 30, figs. 7–8

(Van Heurck, Synopsis, pl. 35, fig. 22; Peragallo, Diat., France, pl. 82, fig. 27.)

This is much nearer to the genus *Synedra* than to *Eunotia.*

Genus RHABDONEMA Kützing

RHABDONEMA ADRIATICUM Kützing

(Van Heurck, Synopsis, pl. 54, figs, 11–13; Schmidt, Atlas, pl. 217, figs. 17–29.)

RHABDONEMA ARCUATUM (Lyngbye) Kützing

(Van Heurck, Synopsis, pl. 54, figs. 14–16; Schmidt, Atlas, pl. 220, figs. 17–22.)

In Smith's British Diatoms, plate 38, his figures 305 and 305+ are good illustrations of this species, but his figures 305*b*, *a′* and *b′* are *R. adriaticum* Kützing.

RHABDONEMA MIRIFICUM W. Smith

(Quart. Journ. Micro. Sci., 1859, pl. 9, fig. 11; Schmidt, Atlas, pl. 217, figs. 1–3.)

Bailey and Harvey call this *Hyalosira punctata* in the Report of the Wilkes Expedition, plate 9, figure 29. Grunow (Oest. Diat., p. 424) creates the genus *Climacosira* for it. De Toni accepts this unnecessary assignment (Syl. Alg., p. 765).

RHABDONEMA SUTUM, new species

Plate 31, figs. 1–2

Frustule in girdle view rectangular, slightly rounded at its four corners and crossed by continuous lines which represent the series of septa that become interpolated between the two ends or valves of the frustule during its process of growth; the two sides of the frustule bordered by bands about one-sixth its diameter, consisting of narrow, straight, closely set costal bars, not enlarged or curved, between which are single rows of small beads of blotches; these rows of beads continue across the frustule and join with those in the opposite band; two median bands, of similar costal bars and beads, but in number only one-half of those in the marginal bands and about twice as long, are separated from each other and from the marginal bands by narrow spaces. crossed only by the continuous beaded lines above mentioned; the costae of the two median bands are bordered on either side by a row of small beads and their ends are enlarged and slightly bent; the two valves and the interpolated septa are seen in face view to be very narrow, slightly dilated at the center and between the center and each end; a hardly perceptible median hyaline line bisects the rectangular beading covering the surface of the valves, the ends being smooth; the interpolated septa are each pierced by two openings, a small oval one, corresponding to one of the dilations near to the end; the other and larger opening beginning at the middle dilation and running to the small dilation near to the other end; the parts of the septum not pierced by openings is cross beaded like the valves and shows the same faint median bisecting line, or pseudorhaphe.

Valve and septum length, 0.133–0.219; width 0.006–0.008; width at middle dilation, 0.010–0.011 mm.

As the halves of each septum are different, one being beaded and the other perforated, and as each septum alternates with the next as to which end is perforated and which not, it follows as above stated, that the costae in the two marginal bands of the frustule are twice as many as those in the two inner bands; for the former, representing the beaded ends of *all the septa*, all show as costae, while the latter, representing the median portions of the septa, only half show as costae, the other half being perforations.

Type.—Cat. No. 43678, U.S.N.M.

Genus RHAPHONEIS Ehrenberg

RHAPHONEIS AMPHICEROS Ehrenberg

(Van Heurck, Synopsis, pl. 36, figs. 22–23; Peragallo, Diat., France, pl. 83, figs. 15–18.)

RHAPHONEIS BILINEATA Cleve

See *Dimeregramma bilineata* (Cleve) Mann.

Genus RHIZOSOLENIA (Ehrenberg) Brightwell

As practically all the material examined for this report was dredgings, any strictly plankton diatoms, like species of this genus and of *Chaetoceros*, may be considered as only accidentally present. A paragraph bearing on this will be found in the Introduction.

RHIZOSOLENIA SETIGERA Brightwell

(Micro. Journ., 1858, pl. 5, fig. 7; Peragallo, Rhizo., pl. 4, figs. 12–16.)

Gran (Nord. Plank Diat., p. 55) claims that *R. hebetata* Bailey is dimorphic, and one of his figures (fig. 67*b*) corresponds with the generally accepted idea of *R. setigera*, while his figure of that diatom is something quite unlike (p. 53. fig. 64). But Brightwell's original illustration cited above, that of Ralfs in Pritchard's Infusoria, plate 7, figure 31, and those of the carefully prepared monograph of Peragallo do not correspond with Gran's distinction. I am unable to throw any more light on the disagreement, but see no reason for changing the generally accepted image of Brightwell's species.

Genus RHOICOSIGMA Grunow

As noted under *Pleurosigma*, this and *Donkinia* are with difficulty separable by well-marked generic lines from *Pleurosigma;* but although these three with *Toxonidia* comprise an unusually compact group, well separated from other genera, and remarkably similar to each other, the division into four genera on rather slight distinctions is an undoubted aid to identification. This is of course ample justification for the arrangement. The distinctions between *Pleurosigma* and *Rhoicosigma* are chiefly two: First, *Rhoicosigma* is bent at the middle, like

Achnanthes, and generally somewhat twisted on its long axis, so that in girdle view the frustule has an angular or bowed outline; and second, the two valves being consequently dissimilar, their relative convexity is different and the trend of the two rhaphes is also different, one becoming more sigmoid than normal and the other less so.

RHOICOSIGMA COMPACTUM (Greville) Grunow

(Peragallo, Pleuro., pl. 10, figs. 7–8; Micro. Journ., 1857, pl. 3, fig. 9.)

RHOICOSIGMA OCEANICUM Peragallo

(Peragallo, Pleuro., pl. 10, figs. 5–6.)

RHOICOSIGMA ROBUSTUM Grunow

(Peragallo, Pleuro., pl. 10, figs. 2–3.)

RHOICOSIGMA WEISSFLOGII Grunow

(Peragallo, Pleuro., pl. 9, figs. 23–24.)

Genus ROPERIA Grunow

ROPERIA TESSELATA (Roper) Grunow

Plate 31, fig. 3

(Van Heurck, Synopsis, pl. 118, figs. 6–7; Quart. Journ. Micro. Sci., 1858, pl. 3, figs. 1*a*–*b*.)

Only one species of *Roperia* is known at present. But a variety so marked and constant as to almost deserve specific rank is a broadly ovoid form in which the pseudonodule is invariably located in the narrow end. The rim also is marked diagonally instead of transversely so that the outer marginal line has a fictitious wavy appearance, especially when slightly out of focus. This is the prevailing form in Philippine Islands material. Its deviation from the type is so striking that it is here illustrated.

Genus RUTILARIA Greville

RUTILARIA PHILIPPINARUM Cleve and Grove

(Le Diat., 1891, p. 64, pl. 10, figs. 1–2.)

RUTILARIA PULCHRA A. Schmidt

(Schmidt, Atlas, pl. 183, fig. 20.)

Schmidt says of the locality merely "S. Monica." As Santa Monica, Calif., is on the seacoast and a fossil diatom deposit is there, this statement is ambiguous. Presumably his type specimen was from the fossil material which is given special prominence in his atlas. I have found it also in the fossil deposit at Jackson's Farm, Oamaru, New Zealand. In that case, the finding it in the Philippine Islands is especially interesting.

RUTILARIA TENUICORNIS Grunow

(Van Heurck, Synopsis, pl. 105, fig. 10.)

Van Heurck hints at the possibility of this being a variety of *R. epsilon* Greville, and De Toni (Syl. Alg., p. 1021) takes that view of it. I dissent. *R. epsilon* is lightly and irregularly marked with crude blotches or beads and tapers gradually from the enlarged middle portion to the apices; *R. tenuicornis* is regularly marked with fine beading, has a relatively much larger middle portion which curves rapidly to the long, narrow, and almost parallel-sided arms. The peculiar lock catch, which joins each frustule with the next and resembles the Greek letter epsilon, is not confined to either of these species, but is general with the *Rutilariae.* (Compare Greville, Micro. Journ., 1863, pl. 9, fig. 1; *R. radiata* Grove and Sturt in Schmidt, Atlas, pl. 183, fig. 22, etc.)

Genus SCEPTRONEIS Ehrenberg

SCEPTRONEIS CUNEATA Grunow

Plate 31, fig. 4

(Grunow, Diat., Hondu., p. 169, pl. 194, figs. *3a–d;* Peragallo, Diat., France, pl. 78, figs. 1–2.)

Peragallo removes this diatom to *Synedra,* where it probably belongs. But I have retained its orginal name because cuneate forms like this can be with about equal justice referred to *Licmophora.* A girdle view of this diatom would settle this, according as it proves to be wedge-shaped or not.

Genus SCOLIOPLEURA Grunow

SCOLIOPLEURA PARTISTRIATA, new species

Plate 31, fig. 5

Valve broad linear, barely sigmoid, with pointed ends; hyaline median area conspicuous, strongly sigmoid, bisected b the delicate rhaphe; central nodule large; markings of strong, transverse, closely set costae, terminating in beads next to the median area, each costa having a large bead at the middle, the single row of larger beads thus formed running parallel to the rhaphe.

Length 0.145; width 0.021; 5.2 lines in 0.01 mm.

This is distinguished from *S. latestriata* (Brébisson), Grunow, as well as from the questionable *S. thumi* H. Heiden (Schmidt, Atlas, pl. 261, figs. 1–3) by both of these having double rows of zigzag beading and peculiarly marked borders on each side of the median area. Cleve's creation of the new genus *Scoliotropis* for these forms and his assignment of *S. tumida* (Brébisson) Rabenhorst to *Navicula* are not to be commended.

Type.—Cat. No. 43679, U.S.N.M.

Genus SKELETONEMA Greville

SKELETONEMA MEDITERRANEANUM (Grunow) Brun

(Van Heurck, Synopsis, pl. 91, figs. 3, 5; Schmidt, Atlas, pl. 180, figs. 38–39.)

The question of placing this diatom here or under *Melosira* is about evenly balanced. Grunow and Schmidt favor *Melosira*, Brun and De Toni *Skeletonema*. If we take Greville's own idea of *Skeletonema* as based on *S. barbadense* (Micro. Journ., 1865, p. 43, pl. 5, fig. 1) this species can not be held generically separate. But if we compare it with more extreme forms, as *S. costatum* (which, strange to say, Greville puts in *Melosira*) or with *S. mirabile*, this assignment becomes questionable. A good illustration of the tangle of *Melosira* and *Skeletonema* for forms of this kind is to be found in Van Heurck's Synopsis, plate 91, figures 3, 4, 5, 6, and in Schmidt's Atlas, plate 180, figure 33, and plate 180, figure 40.

SKELETONEMA MIRABILE Grunow

(Van Heurck, Synopsis, pl. 83, ter, fig. 5.)

This essentially arctic diatom must have made its way to the Philippine Islands by the Japan current, it having been found previously only at Cape Wankarema.

Genus STEPHANOPYXIS Ehrenberg

STEPHANOPYXIS ACULEATA (Ehrenberg?) Grunow

(Schmidt, Atlas, pl. 130, fig. 12.)

This should be distinguished from "*Stephanopyxis aculeata*" Ehrenberg in Mikrogeologie, plate 18, figure 124, which is an indeterminate figure, possibly a *Xanthiopyxis*. (Consult Grunow, Diat. F. Jos. Land, p. 91.)

STEPHANOPYXIS BRUNII A. Schmidt

(Schmidt, Atlas, pl. 164, fig. 5; Van Heurck, Belgica, pl. 6, figs. 90, 92.)

Though originally found in the fossil deposit at Sendai, Japan, Van Heurck subsequently found it in Antarctic dredgings. This third locality discovered is as incongruous as the two others.

STEPHANOPYXIS TURRIS (Greville) Ralfs

(Pritchard, Inf., p. 826, pl. 5, fig. 74; Schmidt, Atlas, pl. 130, figs. 42–43; Grunow, Diat. F. Jos. Land, pl. 5, fig. 7.)

This diatom is widely distributed and supplies many variations, some of which are identical with figures of *S. appendiculata* Ehrenberg, as for example, those in Schmidt's Atlas, plate 130. But Ehrenberg's figure in his Mikrogeologie, plate 18, figure 4, is not at all similiar. De Toni unites the two but gives preference to the later name, which was created by Greville in a note added to Gregory's Diatoms of the Clyde, page 538.

STICTOCYCLUS, new genus

Valve circular, almost flat until, at the apparent rim, it bends vertically downward at right angle to the surface of the disk to form a deep flange about one-third the disk radius in width, thus making each valve a shallow circular half box, the two valves joined by the girdle thus forming a thick frustule; the markings of the flange are the same as and continuous with those of the disk; in the middle of the valve is a small irregular central area, bearing a few minute scattered beads; from the center proceed 50 to 80 sharp but narrow radii extending to the apparent rim and over it to the lower edge of the flange; the spaces between the radii are ornamented with small, densely set beads only obscurely arranged in rows; a comparatively large but not typical pseudonodule is placed in from the apparent rim about one-fourth to one-eighth the radial distance; this is not a glistening body like the true pseudonodule of *Actinocyclus,* because it is not due to a lenticular thickening of the silica, but is like the similar spot in *Roperia* or the ocellus of *Pseudo-Auliscus;* the side (or girdle) view shows the continuity of the vertical flange with the rest of the valve and the flatness of the surface of the disk portion. Markings of the girdle unknown. Only the one species following is so far known.

This exquisitely ornate and delicate diatom, figured and described under the name "*Actinocyclus stictodiscus,*" strangely resembles both these dissimilar genera, a fact indicated by the new name here proposed; but it can not be assigned to either one without introducing objectionable modifications. The vertical flange continuous with the disk, and its pseudonodule exclude it from *Stictodiscus;* the dissimilarity of this pseudonodule from that of *Actinocyclus,* the verticle flange extension of the disk and the radial costae exclude it from *Actinocyclus.* It certainly is more unlike either of these than *Roperia* is unlike *Actinocyclus* or *Arachnoidiscus* unlike *Stictodiscus.* Its side view, here illustrated for the first time, will make this clear. The suggestion of Van Heurck, that it represents a separate genus, is therefore here adopted.

STICTOCYCLUS VARICUS, new name

Plate 32, figs. 1–2

(Van Heurck, Synopsis, pl. 118, fig. 4, misnamed.)

General characters as in the genus. The valves are delicately thin and elastic. The radii adjacent to the pseudonodule on either side are slightly bowed around it.

Diameter to apparent rim, 0.130 to 0.199; width of flange, 0.035 to 0.053; width of sectors at apparent rim, 0.007 to 0.008; diameter of pseudonodule, 0.008 mm.

Type.—Cat. No. 43680, U.S.N.M.

Genus STICTODESMIS Greville

STICTODESMIS AUSTRALIS Greville

(Greville, Diat., So. Pac., p. 34, pl. 1, figs. 1–4; Van Heurck, Treat., p. 237, fig. 34.)

The validity of both the generic and specific names of this diatom deserves discussion. First, as to this being a valid genus: It is claimed by several diatomists that the species of this genus are nothing more than certain diatoms belonging to other genera but which develop craticular plates ("dissepiments") within the frustule, one beneath each valve, similar to the craticular plates of such diatoms as *Navicula cuspidada* Kützing, the separated plates of which long went under the name of *Surirella craticula* Ehrenberg. Thus the present species, *S. australis*, is said to be the craticular state of *Navicula scopulorum* Brébisson (= *Pinnularia johnsonii* W. Smith) according to Van Heurck, Treatise, page 237, Peragallo's Diatomées de la France, plate 8, figure 28, Cleve's Naviculoid Diatoms, volume 1, page 152, etc. *S. australis* is quite abundant at Jolo Jolo, Sulu Islands, Philippine Islands, and has afforded material for a study of the complete frustules and of the valves and their internal dissepiments mounted separately. *Navicula scopulorum* is also abundantly supplied for comparison in H. L. Smith's Types, No. 286. The valves of the two are so similar as to make the claim of their being identical a strong one. But even the valves themselves show certain noteworthy differences, those of *S. australis* being much narrower and very often curved sideways, so as to take on a sickle shape. The rhaphe too is more delicate and with terminations at the center and apices of the valve that remind one of the rhaphe of *Frustulia rhomboides* (Ehrenberg) De Toni. But the important point is that the internal dissepiments are wholly unlike the occasional craticular plates found in other diatoms. They are not irregularly constructed plates, the ribs of which sometimes run transversely from side to side below the valves and sometimes anastomose into an irregular network; but they are the exact counterpart of the dissepiments of *Climacosphenia*, having cross ribs formed into a regular ladder, the opening between these rungs at the middle of the valve being always double that of the others; and at the center of each rung, as in *Climacosphenia*, is a knot where the two halves join. It is quite certain that if *Strictodesmis* is invalid, so also is *Climacosphenia;* if the former is a dimorphic phase of *Navicula*, *Climacosphenia*, is a dimorphic phase of *Licmophora*. Grunow's useful genus *Campyloneis* separates such forms as *C. grevillei* from the genus *Cocconeis* because of just such internal dissepiments as those here discussed, being identical with them in structure and position. So that if the present genus falls to the ground, *Campyloneis* must fall with it. Nor can *Mastogloia* be kept separate from *Navicula* by any definition that will not also justify the separateness of *Stictodesmis;* for *Mastogloia's* sole distinction from *Navicula* lies in the constant dissepiments that form marginal chambered rows beneath each side of the valve, and not in the fact that they grow in gelatinous masses, which is equally true of some other genera, including some of the *Naviculae* proper.

It seems therefore that it is at least admissible to take the position of De Toni and hold this genus separate from *Navicula*. *Stictodesmis australis* occurs at Wake Island. All the diatoms from that locality are exceptionally poor in silica; and it is noteworthy that where individuals appear to lack the internal dissepiment a careful examination invaribly shows it to be present as an almost invisible, unsilicified structure.

Confirmatory of the foregoing, Mereschkowsky (Ann. Mag. Nat. Hist., p. 415, 1901) proposes to restore the defunct genus, *Okedenia* Eulenstein, so as to accommodate this species; because he finds that its chromophores are totally unlike those of any known *Navicula*, and therefore he insists that *Navicula scopulorum* Brébisson is generically misplaced, believing that it and *Stictodesmis australis* are identical. But afterwards (Ann. Mag. Nat. Hist., p. 32, 1902) in reviewing Karsten's Diatoms of Kiel, he accepts the latter author's figures of the chromatophores of *Navicula scopulorum* and writes they reveal that *N. scopulorum* is valid, but nevertheless is a totally different diatom from his *Okedenia scopulorum;* in other words, from *Stictodesmis australis*. This, as above remarked, is confirmatory of the point now being discussed, namely, not the validity of *N. scopulorum* but the validity of *S. australis* Greville.

As to the correct name for this genus there is more question. *Stictodesmis* Greville and *Climaconeis* Grunow seem to be synonymous, the latter having been published a year before the former—1862 and 1863. If this is correct, Grunow's generic and specific names for this diatom, *Climaconeis lorenzii*, would replace Greville's. Although I think this view is probably right I am here retaining Greville's name because of the unaccountable absence of any rhaphe in either Grunow's figure or description of *C. lorenzii* or of his other species, *C. frauenfeldii* the former from the eastern shore of the Adriatic, the latter from the Red Sea. Nor is there an observable rhaphe in specimens I have found in the fossil Marine deposit at Jackson's Farm, Oamaru, New Zealand, which seem to be identical with *C. frauenfeldii* (Oest. Diat., Wien.Verh., 1862, p. 421, pl. 7, fig. 2, and pl. 8, fig. 7). How so experienced a diatomist as Grunow could leave out of both figure and description a factor of such importance as he knew the rhaphe to be is beyond conjecture; and as I am unable to settle this point by a study of Grunow's original type, I am retaining the name given in Greville's publication, where the rhaphe is clearly indicated.

Genus STICTODISCUS Greville

STICTODISCUS AFFINIS Castracane

(Castracane, Chall. Exp., p. 119, pl. 1, figs. 4, 6.)

This seems to be a Philippine Islands form, its type having come from Zebu. It would be possible to classify it as a wide variety of the variable *S. californicus* Greville.

STICTODISCUS ARGUS A. Schmidt

(Schmidt, Atlas, pl. 74, fig. 12.)

STICTODISCUS BICORONATUS Castracane

See *Trigonium bicoronatum* (Castracane) Mann.

STICTODISCUS CALIFORNICUS Greville

Plate 33, fig. 1

(Micro. Journ., 1861, p. 79, pl. 10. fig. 1; Schmidt, Atlas, pl. 74, figs. 4–5.)

Recorded by De Toni only in fossil deposits, but it is rather frequent along the Pacific coast and the Hawaiian Islands. Very variable. The original type form and several varieties are common in the Philippine Islands. An interesting monstrosity which probably belongs to this species is here illustrated.

STICTODISCUS EULENSTEINII (Grunow) Castracane

See *Trigonium eulensteinii* (Grunow) Mann.

STICTODISCUS JAPONICUS Castracane

(Castracane, Chall. Exp., p. 119, pl. 1, figs. 2, 4.)

Like Castracane's *S. affinis*, it is too close to *S. californicus*.

STICTODISCUS KITTONIANUS Greville

(Micro. Journ., 1861, pl. 10, fig. 2; Schmidt, Atlas, pl. 74, figs. 16–18.)

STICTODISCUS MULTIFURCATUS Bergon, misnamed

(Le Diat., 1890, p. 3, pl. 2, fig. 1.)

This is *S. nankoorensis* Grunow in Reise *Fregatta* Novara, plate 1A, figure 23; but it is worth recording that the single specimen found by me duplicates exactly the figure given above, the locality of which is given only as "Soundings of the Challenger Expedition."

STICTODISCUS MULTIPLEX Janisch

See *Trigonium multiplex* (Janisch) Mann,

STICTODISCUS NANKOORENSIS Grunow

(Grunow, Reise F. Nov., pl. 1A, fig. 23.)

The figure in Schmidt's Atlas (pl. 74, fig. 2) shows the nearness of this to *S. californicus*, of which it is indeed generally made a variety. I follow De Toni in listing it separately solely as a convenience in identification.

STICTODISCUS NITIDUS Grove and Sturt

Plate 32, fig. 3

(Schmidt, Atlas, pl. 131, fig. 7; compare Grove and Sturt, Oam. Diat., pl. 5 fig. 7.)

The specimen found by me varies somewhat from the type, makeing this identification doubtful, especially as the species has not been found hitherto except in the fossil deposit at Oamaru, New Zealand If we consider it merely a wide variety of *S. californicus*, the view originally taken by Grove and Sturt, its presence in the Philippine Islands, where *S. californicus* is abundant, would be more easily understood. I have felt it to be worth while to illustrate here the Philippine Islands form which agrees with Schmidt's figure as to its peculiar border and the large, irregularly scattered beads, the latter, however, being more abundant in my specimen.

STICTODISCUS PARALLELUS (Greville) Grove and Sturt

(Schmidt, Atlas, pl. 75, fig. 13; pl. 76, figs. 15–16; pl. 131, fig. 9.)

The last reference above is the prevailing form in the Philippine Islands, called by Grove and Sturt variety *gibbosa*.

STICTODISCUS RADFORDIANUS Castracane

See *Trigonium radfordianum* (Castracane) Mann.

STICTODISCUS RADIATUS Castracane

(Castracane, Chall. Exp., pl. 1, fig. 1.)

Hardly separable from *S. californicus*. It seems to be peculiar to the Philippine Islands, the original type having been found there at Zebu.

STICTODISCUS SIMPLEX A. Schmidt

(Schmidt, Atlas, pl. 74, fig. 11.)

Found originally in San Francisco Bay, Calif. The single small but evident bead at the center of the valve appears in the specimens found by me and seems to be constant.

STICTODISCUS VARIANS Castracane

(Castracane, Chall. Exp., p. 120, pl. 17, fig. 7.)

A review of the comments made under the different species of *Stictodiscus* here listed makes it evident that, although the genus itself is well defined, its species are usually inconstant, a large part of them seeming to be only variations of *S. californicus*, a species which unquestionably shows extreme variability.

Genus STOSCHIA Janisch (invalid)

STOSCHIA ADMIRABILIS Janisch

See *Coscinodiscus reniformis* Castracane.

Genus SURIRELLA Turpin

SURIRELLA BERTILLONII, new species

Plate 33, fig. 2

Valve reniform by lateral expansion, not by an incurving of one side, the two polar ends being joined by the narrower axis, one end at the middle of the convex margin the other in the sinus of the concave margin; border massive, its outer edge strongly crossbarred; within this is a row of wedge-shaped elevations, touching each other at the outer wide ends, from the inner and pointed ends of which proceed single or double curved rows of beads to the pear-shaped central area of the valve; this area extends across the middle of the valve, its narrower end being at the polar point or center on the convex side and its wider end at the other polar point or center on the concave side of the valve; it is bounded by a fringe of closely set, short, radiating lines, like the cilia around certain Infusoria, and its surface is marked with dim scattered beads or blotches.

Longer (lateral) diameter, 0.087–0.097; shorter (polar) diameter, 0.046–0.050 mm.

Like *Surirella reniformis* Grunow and *Coscinodiscus reniformis* Castracane (=*Stoschia admirabilis* Janisch), this kidney-shaped diatom at first seems to be only an odd monstrosity. But on fuller acquaintance it displays a uniformity of shape that entitles it to specific rank. *C. reniformis* Castracane proves to be abundant in many widely separated localities and is everywhere true to its curious shape. So also is *S. reniformis* Grunow. Both are abundant in the Philippine Islands and all the specimens keep close to the type form. This species, *S. bertillonii*, was found in three quite dissimilar dredgings and exhibits practically no variation, either in outline or in plan of sculpture.

The specific name here given refers to the very curious resemblance of its markings to the thumb prints used in the Bertillon system of criminology.

Type.—Cat. No. 43681, U.S.N.M.

SURIRELLA CASTRACANEI De Toni

(De Toni, Syl. Alg., p. 588. See Castracane, Challenger Exp., p. 61, pl. 10, fig. 6.)

Castracane's name, *S. multicostata*, being preempted by Leuduger-Fortmorel (Diat., Ceyl., pl. 3, fig. 40), De Toni renames it as above. Schmidt subsequently named the same diatom *S. sumbawana* (Schmidt, Atlas, pl. 205, figs. 1–2).

SURIRELLA CEYLANENSIS Leuduger-Fortmorel

(Leuduger-Fortmorel, Diat., Ceyl., pl. 3, fig. 38; Schmidt, Atlas, pl. 309, figs. 4–5.)

The Philippine Islands form is the trivial variation from type that Hustedt calls var. *oblongistriata* in the above reference in Schmidt's Atlas.

SURIRELLA COMIS A. Schmidt

(Schmidt, Atlas, pl. 4, figs, 3–7; pl. 20, fig. 3.)

SURIRELLA CONCENTRICA, new species

Plate 34, fig. 1

Valve broadly oval, its outer band or rim narrow but stout, cross-barred with closely set lines and bisected by a fine wavy median line, the outer half of the rim being further ornamented with widely separated, evenly spaced, shadowy rings or dots; within the rim narrow ribs or costae proceed radially toward the center, making a band about one-quarter the width of the valve in diameter and leaving a hyaline central area about one-half the valve's diameter in size, in which there is no median line; each costa begins at the outer band with a hardly perceptible enlargement, but is bordered for a short distance near its middle part with a row of fine beads on either side; these double rows of beads taken together appear as a smaller concentric band passing across the middle of the costal bands; polar areas terminating the longer axis are well defined, and are each marked with a semicircular protuberance.

Long diameter, 0.157; short diameter, 0.114 mm.

Type.—Cat. No. 43682, U.S.N.M.

SURIRELLA CONTIGUA, new species

Plate 34, fig. 2

Valve elongated ovate, one end much broader than the other; outer rim a narrow band; no alae; the costae begin at the outside margin, crossing the rim and approaching almost to the center of the valve, but leaving a pronounced tortuous hyaline central area, extending the length of the valve; the costae in the middle portion of the valve are transverse, but near each end become rapidly more radial and outwardly curved; between the costae are fine, closely set parallel lines of minute beading, three to six between each pair of costae.

Long diameter 0.073–0.126; short diameter 0.038–0.071; 17.5 fine lines in 0.01 mm.

This species bears an interestingly close resemblance to the fresh-water diatom *S. gemma* Ehrenberg, the similarity being referred to in the specific name here selected. Its intercostal lines are somewhat coarser and its strongly ovate shape and broad central area sharply differentiate them. A very similar but much larger species occurs at Panama and is here figured for comparison; see plate 34, figure 3. I have named it *S. foliata*, new species. It will be described in a forthcoming paper on the Diatoms of Panama.

Type.—Cat. No. 43683, U.S.N.M.

SURIRELLA CONTINUATA, new species

Plate 33, fig. 3

Valve a broad oval, the outer rim narrow, stout, finely crossbarred and beset with a row of minute processes near the outer edge; no alae; the costae or ribs begin at the rim in a row of lozenge-shaped enlargements elevated above the rim and draw to a point at their outer angle; from there inward they are very narrow, without beading, but showing two undulations, a strong sharp one a little less than half the distance to the middle of the valve, thereby producing the effect of an inner oval parallel with the outer one, and a second less pronounced undulation appearing as a still smaller oval within the other; the costae extend clear to the median line, those from one side generally, but not invariably, continous with those from the other side; polar areas on the margin evident.

Long diameter, 0.162; short diameter, 0.097 mm.

The nearest known species to this is *S. tridens* A. Schmidt (Atlas, pl. 206, fig. 177) from the not distant Sumbawa.

Type.—Cat. No. 43684, U.S.N.M.

SURIRELLA CUNEATA A. Schmidt

(Schmidt, Atlas, pl. 4, figs. 1–2.)

Possibly a variety of *S. fastuosa* Ehrenberg.

SURIRELLA CUNEATELLA, new species

Plate 33, fig. 4

Valve narrow ovate, small but robust; rim narrow but heavy, strongly and closely crossbarred; ribs or costae beginning at the margin in very large pear-shaped plates elevated above the rim, striped lengthwise with strong moniliform lines and bearing one to three minute teeth on the broad outer end; short and very thin costa connect the small internal ends of the plates with a narrow median area, which is bounded by a closely set row of transverse lines; polar areas of the long diameter obscure.

Long diameter, 0.065–0.071; short diameter, 0.034–0.035 mm.

This belongs to the loosely defined *S. fastuosa* Ehrenberg group. It is rather abundant in Philippine Islands material, is uniformly minute but robust and heavy and strongly ovate. In shape it resembles Schmidt's *S. cuneata* (Schmidt, Atlas, pl. 4, fig. 2), which is, however, much larger, relatively less massive, and has a different border. It is perhaps nearest to the unnamed figure in Schmidt's Atlas (pl. 4, fig. 23) from the relatively near-by Surabaya, Java.

Type.—Cat. No. 43685, U.S.N.M.

SURIRELLA CURVIFACIES Brun

(Brun, Lac. Mar., ou Foss. Diat., pl. 15, figs. 36–37; Schmidt, Atlas, pl. 283, fig. 12.)

The dates of publication of the above two identical diatoms are Brun's name 1895, and the Atlas *S. trauensteinii* Hustedt, 1912.

SURIRELLA DEFLEXA A. Schmidt

(Janisch, Gaz. Exp., pl. 19, fig. 5; Schmidt, Atlas, pl. 20, fig. 2; pl. 205, figs. 5–6.)

Schmidt's objections to the suggestion of Brun that *S. incurvata* (pl. 205, figs. 5–6) is a variety of *S. ceylanensis* Leuduger-Fortmorel and to the suggestion of Grove that it is an abnormality of *S. macraeana* Greville are both correct. But Janisch rightly takes it to be a narrow variety of *S. deflexa.* Note the perfect identity of the border and the ribs. These, taken with the curious deflexion of the middle area, make any other view untenable.

SURIRELLA FACILIS, new species

Plate 35, fig. 2

Valve panduriform, the middle constriction gradual and shallow, the ends semicircular; border narrow, transversely lined, and having superimposed upon it minute beads, one to each rib, and alternating with, not opposite, their ends; ribs distinct but very narrow and hyaline, those at the middle part of the valve without enlargement, those toward the ends of the valve very slightly enlarged, thence running to and touching a well-defined central area, the middle ribs being strictly transverse, the end ribs radial; the central area is bordered on either side by a strong row of closely set dashes, the two rows approaching at their middle portion and flaring at their ends, the ends being open; faint dashes mark the two wide outer parts of this central area.

Length, 0.184; width, 0.092 mm.

This diatom is well figured by Janisch (Gaz. Exp., pl. 16, fig. 13), but not named. By comparing it with figure 3 of the same plate its slight similarity to *S. macraeana* Greville will be seen. It also has some likeness to figure 10 on the same plate, *S. studeri,* particularly in the width of its border and the narrowness of its ribs.

Type.—Cat. No. 43686, U.S.N.M.

SURIRELLA FASTUOSA Ehrenberg

(Schmidt, Atlas, pl. 4, figs. 7–15; pl. 19, figs. 1, 8, 13; Micro. Journ., 1862, pl. 3, fig. 1.)

A cosmopolitan marine species, with many striking variations. Those figured in Schmidt's Atlas, plate 5, figures 7–9, 11, 14, are peculiar to both Campeche Bay and the Philippine Islands.

SURIRELLA FAUSTA A. Schmidt

Plate 35, fig 3

(Schmidt, Atlas, pl. 4, fig. 20.)

The deep pits in the ribs of this species are well seen in the specimens found, illustrations of which are here given, Schmidt's type figure being rather poor.

SURIRELLA FLUMINENSIS Grunow

(Schmidt, Atlas, pl. 5, fig. 6; Peragallo, Diat. France, pl. 60, fig. 1.)

SURIRELLA GRANDIUSCULA Castracane

(Castracane, Challenger Exp., pl. 10, fig. 5.)

SURIRELLA GRAVIS, new species

Plate 33, fig. 5

Valve a perfect oval; the rim is heavy, strongly crossbarred and faintly indented, the indentations corresponding with the ends of the ribs or costae; these begin in small but massive knobs elevated above the rim and having a heavy, blunt, process on the outer side; the ribs or costae extend inward from these knobs to the middle and are transverse, except toward the two ends; they are very thin, but deep, and thereby sharply defined; they are widely separated and have between the knobs faintly ribbed scallops next to the rim; a minute angle in each costa near its middle produces a shadowy internal oval, parallel to the margin; the number of costae on each side is the same and they generally are continuous across the valve; there is no median area; the two polar areas of the long diameter are well defined.

Long diameter 0.079–0.113; short diameter 0.048–0.066 mm.

The sculpturing of this species is similar to that of the unnamed figure in Schmidt's Atlas, plate 56, figure 6, and less so to *S. apiae* Witt (Mus. Godef., p. 114, pl. 15, fig. 4). It is the most massively built *Surirella* I have seen.

Type.—Cat. No. 43687, U.S.N.M.

SURIRELLA HYBRIDA Grunow

(Van Heurck, Synopsis, pl. 73, fig. 17; Peragallo, Diat., France, pl. 64, figs. 1–6.)

A solitary specimen of this diatom was found by E. Leonard, Liverpool, England, in material supplied by me. Van Heurck in the text of his Synopsis (p. 188) puts this under *S. fastuosa* Ehrenberg. It is better to hold it separate, as is done by Peragallo.

SURIRELLA IMITANS, new species

Plate 34, fig. 4

Valve circular, rim broad and massive, marked with strong, closely set crosslines and bisected by a median line; costae beginning with small pentagonal plates elevated above the rim and having four to six spines on the outer edge, the two side spines being largest; the costae running inward from these plates are narrow but deep and therefore sharply defined, radial, each with a slight angular bend at its middle; no central area; polar areas large.

Diameter, 0.061 mm.

There are a number of circular *Surirellae*, simulating the genus *Campylodiscus*, but without the double bend of that genus; none resemble the present species closely.

Type.—Cat. No. 43688, U.S.N.M.

SURIRELLA INCURVATA A. Schmidt

See *S. deflexa* A. Schmidt.

SURIRELLA INTERCEDENS Grunow

(Schmidt, Atlas, pl. 19, figs. 5–6.)

SURIRELLA LATA W. Smith

(Smith, Brit. Diat., pl. 9, fig. 61; Schmidt, Atlas, pl. 5, fig. 1; Schmidt Nordsee, pl. 3, fig. 9.)

De Toni's union of this with *S. fastuosa* is not warranted. The ribs of the latter are longitudinally striped; of the former marked with a cluster of closely set beads at the inner end of each rib, which is very short and broad.

SURIRELLA LAXA Janisch

(Janisch, Gaz. Exp., pl. 21, figs. 25–27; Schmidt, Atlas, pl. 56, figs. 3–4.)

The finely beaded margins of the short, heavy ribs is finely brought out in Schmidt's figures.

SURIRELLA MACRAEANA Greville

Plate 34, figs. 5–7; plate 35, fig. 1

(Micro. Journ., 1862, pl. 2, fig. 1; Janisch, Gaz. Exp., pl. 16, figs. 2–4; pl. 19, fig. 1.)

The great variability of this species has induced me to give four figures, that of the girdle view being specially needed in diatom literature.

SURIRELLA MOLLIS A. Schmidt

See *S. schleinitzii.*

SURIRELLA ORIENTALIS, new species

Plate 36, fig. 1

Valve elliptical, slightly constricted at the middle; that is, imperfectly panduriform; rim broad, heavy, coarsely crossbarred; alae obscure or wanting; costae beginning with lozenge-shaped pointed plates elevated above the rim, thence extending transversely to the middle, except at the ends of the valve, where they become oblique;

very narrow except close to the row of outer plates where there is a short thickening obscurely marked with a double row of beads; no median area; polar areas evident.

Long diameter, 0.117–0.194; short diameter, 0.066–0.112 mm.

S. lata W. Smith (Smith, Brit. Diat., pl. 9, fig. 61), *S. macraeana* Greville (Micro. Journ., 1862, pl. 2, fig. 1) and the somewhat unrelated figure in Peragllo's Diatomées de la France, plate 61, figure 6, called *S. lata*, var. *macraeana;* also *S. mexicana* A. Schmidt (Atlas, pl. 4, figs. 10–12), *S. japonica* A. Schmidt (Atlas, pl. 4, fig. 15), *S. pacifica* A. Schmidt (Atlas, pl. 4, fig. 19), together with the above, form a group of related species that show a more or less close similarity. The present species is practically without alae, there is no trace of central area, the marginal plates from which the costae arise are lozenge-shaped and sharply pointed at their outer ends. It is therefore unsatisfactory to call it a variety of any of the foregoing. It is rather plentiful in several of the Philippine Islands dredgings.

Type.—Cat. No. 43689, U.S.N.M.

SURIRELLA PATENS A. Schmidt

(Schmidt, Atlas, pl. 4, figs. 16–17; pl. 56, figs. 10–11; Janisch, Gaz. Exp., pl. 21, figs. 28–29.)

This is rather close to *S. ceylanensis* Leuduger-Fortmorel.

SURIRELLA RECEDENS A. Schmidt

(Schmidt, Atlas, pl. 19, figs. 2–4; pl. 24, fig. 28.)

SURIRELLA RENIFORMIS Grunow

(Schmidt, Atlas, pl. 309, fig. 9; Grunow. Diat. Hond., pl. 194, figs. 8–9*a–b*.)

Grunow first named this *Plagiodiscus martensianus* (fig. 8 above) and *P. nervatus* (fig. 9*a–b*) in his Honduras Diatoms (Micro. Journ., 1877). It is common in the Philippine Islands and, curiously, was given the name *reniformis* by me before I discovered Grunow's identification. It occurs also in the Hawaiian Islands at Hilo, at Laysan Island, etc.

SURIRELLA SCHLEINITZII Janisch

(Janisch, Gaz. Exp., pl. 19, fig. 7; Schmidt, Atlas, pl. 206, figs. 18–19.)

The report on the diatoms of the *Gazelle* Expedition was issued by C. Janisch in sixteen photographic plates, accompanied by a text naming only part of the figures. It was distributed to quite a number of diatomists in either 1888 or 1889. Grunow refers to Janisch's report on the *Gazelle* diatoms in the Botanisches Centralblatt of 1888, but Rattray in his Revision of *Coscinodiscus* states that it was "read June 17th, 1889." It is included in diatom bibliography by De Toni, Rattray, and others and is extensively referred to in diatom literature.

Its names therefore are to be reckoned with; and the above has priority over *S. mollis* A. Schmidt, in the second reference above, the date of which is 1897. The diatom is curiously unlike other Surirellae in having the ribs extremely short around the margin, with no trace of a separate median area or other markings; and it is practically identical with the so-called *Campylodiscus anceps* Castracane (Chall. Exp., p. 66, pl. 16, fig. 2, 1886) which Janisch later called *C. similis* (Gaz. Exp., pl. 19, fig. 8) because of the resemblance here noted. This latter differs from *S. schleinitzii* merely in being circular instead of figure 8 shaped, is perfectly flat instead of having the *Campylodiscus* double curvature and, it may be incidentally mentioned, is probably a constant and curious variety of this unique species. Both are rather frequent in the Philippine Islands.

SURIRELLA SIGNIFICANS, new species

Plate 36, fig. 2

Valve broadly elliptical; border double, that is, divided by a median line into an outer and an inner half; heavy, marked with coarse beaded crosslines; ribs or costae with broad, rectangular outer ends overlapping the border and having two teeth or spines next to the margin; proceeding inward from these ends the ribs are narrow for about one-third their length, where they swell into a small knot or joint and then continue as still narrower lines until they meet the ribs of the opposite side or reach a small circular area in the center of the valve; this last is exactly central, is bordered by a sharply defined line or ridge, and is so perfectly hyaline as to appear like a circular hole. Its size is in every case proportionate to the size of the valve, being about one-sixth its transverse diameter.

Length of valve, 0.066 to 0.103; width, 0.046 to 0.082 mm.

Type.—Cat. No. 43690, U.S.N.M.

SURIRELLA STUDERI Janisch

Plate 35, fig. 4

(Janisch, Gaz. Exp., pl. 16, fig. 10.)

My specimens exactly duplicate the type form figured in the above, which I believe is the only illustration of this fine and rare diatom, for which reason it is figured here.

Unfortunately no locality is given for the type.

SURIRELLA SULUENSIS, new species

Plate 36, fig. 3

Valve broadly elliptical, massive; border heavy, coarsely crosslined; outer ends of the costae superimposed on the border, lozenge-shaped; outer third of the costae made up of twin rows of fine transverse lines, the remaining two-thirds thin, unmarked, narrowing down until they totally disappear before they reach the middle of the valve; this latter indefinite in contour, because not bounded by any investing line, hyaline, except for a few scattered watery dashes; polar areas evident.

Length, 0.200; width, 0.153 mm.

In general shape this resembles the one shown in Schmidt's Atlas, plate 5, figure 8, which, however, as there stated, is a variety of *S. fastuosa* Ehrenberg. This differs from that species in three respects: it has no well-defined central area; the outer ends of the costae are not wedge shaped with one to three teeth on the marginal side; the broad part of the costae is not marked with longitudinal but with transverse lines. Found only at Jolo Jolo Harbor; there frequent.

Type—Cat. No. 43691, U.S.N.M.

SURIRELLA TAHITIANA Castracane

(Castracane, Chall. Exp., p. 61, pl. 19, fig. 3.)

SYNDENDRIUM DIADEMA Ehrenberg

See *Chaetoceros diadema* (Ehrenberg) Gran.

Genus SYNEDRA Ehrenberg

SYNEDRA CRYSTALLINA (Agardh) Kützing

(Van Heurck, Synopsis, pl. 42, fig. 10; Peragallo, Diat., France, pl. 79, figs. 1–4.)

The removal of this and a few other species into a new genus, *Ardissonia*, on the basis of the division of the transverse rows of beading by longitudinal lines, is not to be commended.

SYNEDRA CUNEATA (Grunow) Peragallo

(Peragallo, Diat. France, pl. 78, figs. 1–2.)

See *Sceptroneis cuneata* Grunow.

SYNEDRA FULGENS W. Smith

(Smith, Brit. Diat., pl. 12, fig. 103; Van Heurck, Synopsis, pl. 43, figs. 1–4; Peragallo, Diat., France, pl. 79, figs. 5–6.)

SYNEDRA PULCHERRIMA Hantzsch

Plate 37, fig. 1

(Hantzsch, Diat., Ostind. Arch., p. 19, pl. 5, fig. 2.)

This apparently rare species is not uncommon in the Philippine Islands. The type was found in the near-by East India Archipelago, described in 1863 and never recorded since. My specimens are all larger than that of the type as given by Hantzsch, but only slightly wider, namely—length, 0.615; width, 0.031; width of ends, 0.038; 8.5 to 9 lines in 0.01 mm., the type being length 0.24 to 0.36, width 0.017 to 0.029 mm.

As there is only one figure of this species published, and in a paper not easily obtained, I give a photograph here. To those who see an advantage in Grunow's creation of the genus *Ardissonia*, for these robust Synedral forms with hyaline side lines, this species would be so classified.

SYNEDRA ROBUSTA Ralfs

(Van Heurck, Synopsis, pl. 42, figs. 6–7; Pritchard, Inf., pl. 8, fig. 3; Peragallo, Diat., France, pl. 78, figs. 3–5.)

This is not easily separable from *S. formosa* Hantzsch.

SYNEDRA UNDULATA (Bailey) W. Smith

(Gregory, Diat., Clyde, pl. 14, fig. 107; Van Heurck, Synopsis, pl. 42, fig. 2; Peragallo, Diat., France, pl. 78, fig. 7.)

Genus SYRINGIDIUM Ehrenberg

SYRINGIDUM DAEMON Greville

(Micro. Journ., 1866, p. 83, pl. 9, figs. 22–28.)

This species and *S. americanum* L. W. Bailey (Van Heurck, Synopsis, pl. 106, fig. 2) are closely alike; the latter was named in 1861 (Bost. Journ. Nat. Hist., pl. 2, figs. 62–64).

Genus TERPSINOE Ehrenberg

TERPSINOE INTERMEDIA Grunow

(Schmidt, Atlas, pl. 199, figs. 1–8.)

TERPSINOE MUSICA Ehrenberg

(Schmidt, Atlas, pl. 199, figs. 9–13.)

Genus THALASSIOTHRIX Cleve and Grunow

THALASSIOTHRIX FRAUENFELDII Grunow

(Van Heurck, Synopsis, pl. 37, figs. 12–15; Gran, Nord. Plankt., p. 117, fig. 159.)

This strictly plankton diatom was only accidentally met with in these dredgings.

TRIBRACHIA, new genus

Diatoms growing in chains, each member joined to the next by means of three long, spirally twisted arms; in side (girdle) view each frustule is seen to be a cylinder, its length about three times its width, the ends (valves) being convex; from the margin of each valve there arise vertically three massive, hyaline arms, sharply bowed inward at the middle, so that they interlace, and also having a slightly spiral twist; at their extremities they are joined to the three corresponding arms of the next frustule, not end to end but by lateral contact; their length is somewhat above one-half that of the cylindrical frustule, so that each cylinder in the chain is widely separated from those on either side of it; no markings except a very obscure rugosity spread over the entire surface of the frustule, exclusive of the arms; the valve view discloses no fact of structure except that the frustules are strictly cylindrical.

This remarkable genus bears only a slight resemblance to other chain-forming genera, like *Skeletonema, Corethron, Stephanopyxis,* and Greville's grotesque genus, *Thaumatonema.* The arms are so strong and their ends so firmly welded with those of the next frustule that any break in the chain invariably occurs across the cylinder, rather than in the arms.

TRIBRACHIA PELLUCIDA, new species

Plate 37, fig. 2

General characters those of the genus. The perfectly hyaline arms and the merely slight rugosity of the cylinders give to this diatom a remarkably crystalline clearness like finely molded glass. It is infrequent, even in the few dredgings where it occurs; for although several specimens were secured, they are rarely met with, those secured probably representing all that were present, as their robust resistance to breakage and their striking appearance would insure their being found.

Length of cylinder, 0.061–0.071; width, 0.015–0.025; length of cylinder with arms, 0.153–0.166 mm.

Type.—Cat. No. 43692, U.S.N.M.

Genus TRIGONIUM Cleve

TRIGONIUM ARCTICUM (Brightwell) Cleve

This is Cleve's type species of the present genus. For a discussion of the necessity of this genus to accommodate forms once included in the impossible genus *Triceratium* and not assignable to other genera, see under *Trigonium* in Mann's Diatoms of the Albatross Voyages, page 289. In the present species is included Brun's *T. cyclamen* (Schmidt, Atlas, pl. 165, fig. 5) probably also the following species.

TRIGONIUM BALAENA (Ehrenberg) Cleve

(Peragallo, Diat., France, pl. 105, figs. 1–3; Micro. Journ., 1859, pl. 9, fig. 15.)

This is possibly a two-angled form of *T. arctium.* Bailey gives a good figure of it in his New Species and Localities of Microscopical Organisms, plate 1, figure 29, with the name *Zygoceros radiatus.* Brightwell in the second reference above puts it in *Biddulphia.*

TRIGONIUM BICORONATUM (Castracane) Mann

Plate 37, fig. 4, and plate 38, figs. 1–3

For a discussion of this see under *Trigonium eulensteinii* (Grunow) Mann.

TRIGONIUM CAELATUM (Janisch) Mann

(Schmidt, Atlas, pl. 81, fig. 19.)

De Toni rightly rejects Grove and Sturt's, including this diatom under their *T. plenum* (*T. weissflogii*), to which it has only the most superficial resemblance. (Syl. Alg., p. 949; Grove and Sturt, Oam. Diat., p. 328, pl. 11, fig. 22.)

TRIGONIUM CINNAMOMEUM (Greville) Mann

(Micro. Journ., 1863, pl. 9, fig. 12; Van Huerck, Synopsis, pl. 126, fig. 1.)

Grunow's assignment of this to *Cestodiscus*, indorsed by Van Huerck, as well as his suggestion that it be put in a new genus, *Pseudotriceratium*, favorably mentioned by Van Huerck, are both unsatisfactory. It seems better to accept Greville's original view, as De Toni does, but to change the wholly untenable name *Triceratium* into its true correlative, *Trigonium*, the generic title proposed by Cleve for just such members of *Triceratium* as this one is. For a full treatment of this question see my Diatoms of the Albatross Voyages, page 292.

TRIGONIUM CONTUMAX, new species

Plate 39, fig. 6

Valve ridgedly triangular, with straight sides and acute angles; central portion slightly depressed below the sides and the even more elevated apices; markings a marginal row of coarse, roundish or square blotches extending into the apices, arranged in well-separated rows that are almost perpendicular to the side, but more truly continuous with radii drawn from the center of the valve; these radii are represented by shining watery lines, running from each row of beads to the center, at which there is a small rosette of similar round or roundish beads; in side (girdle) view the slight depression of the central portion of the valve and the very slight elevation of the angles above the sides are clearly seen; the line of demarcation between the girdle and the downward curve of each valve is marked by a narrow sinus or groove running around the frustule; the girdle is almost hyaline, except for a single row of widely separated beads on its upper and its under edge.

Diameter, 0.0486–0.0873; lines of beads at margin, 3 in 0.01 mm.

This diatom has some resemblance to a number of species, particularly to *T. margaritiferum* Cleve (New and Little-known Diat., p. 26, pl. 6, fig. 76), which, however, has concave sides, blunt apices, and no radiating lines. Cleve found it in the Galapagos Islands. It also somewhat resembles the misnamed figures in Truan and Witt's Diatoms of Hayti, plate 5, figure 9, and plate 6, figure 16, there called *Stictodiscus johnsonianus* Greville. There is indeed a specious resemblance here to the genus *Stictodiscus*, (1) because of the watery lines so common in that genus, and even more so, (2) because of an apparent rim or border around the edge of the valve. This latter, however, is an illusion, due to the appearance of the rows of beading when seen on the curving edge of the valve; for the side (girdle) view shows that no such border or rim exists. It also shows the above-mentioned sinus where the valve joins the girdle, a construction never found in *Stictodiscus.* This is therefore an illustration of the desirability of obtaining both face and girdle views of such diatoms. Both valves are alike in their shape, a fact which would also exclude this from *Stictodiscus* if we accept the generally expressed statement that the two valves of *Stictodiscus* differ in their convexity. (See Van Heurck's Treat. Diat., p. 506.) This, however, is not to be relied upon. *St. californicus* Greville, for example, rarely has its two valves of different convexity. This new species is well distributed and fairly abundant at the Philippine Islands.

Type.—Cat. No. 43693, U.S.N.M.

TRIGONIUM DIAPHANUM, new species

Plate 37, fig. 3

Valve only slightly convex, but near the margin turning rapidly downward to form a deep vertical flange or rim that joins the girdle of the frustule; three to five angled, the sides between the angles convex, except occasionally in triangular specimens, where they are practically straight; surface of the valve covered with small beads in radiating rows, gradually enlarging from the center to the sides, where they sometimes become imperfectly square or hexagonal from pressure, the separate beads having each a minute central dot (prickle?), the larger polygonal ones a more or less rugose appearance; the beading of the three to five produced and rounded angles is finer and more closely set than that of the rest of the valve; at the center is a conspicuous cluster of small spines grouped into an imperfect rosette or sometimes a ring. Under moderate magnification this diatom has a delicate, lacy appearance.

Diameter (apex of angle to middle of opposite side) 0.135–0.231 mm.

This species is the unnamed figure in Janisch's Report of the Gazelle Expedition, plate 9, figure 1. From the fact that his photograph was made from a broken specimen we may infer that it was rare in his material. It is remarkably abundant in some of the Philippine Islands dredgings, the three, four, or five angled forms being often found together in the same strewing. The four-angled forms generally predominate. Although this species is thin and gossamer-like it is very conspicuous in a dry strewing, not only because of its considerable size, but because it arrests attention by its fine prismatic coloring, the main portion of the valve being a bluish-green and the more finely beaded angles a soft buff or straw color.

It is much like the figure in Schmidt's Atlas (pl. 79, fig. 1) but not quite identical. Schmidt incorrectly calls this *Amphitetras graeffeiana* Witt. It may be well to state here that the true *A. graeffeiana* Witt is a very coarse diatom, with well separated rectangular beads (figured and described in Journ. Mus. Godeff., 1873, p. 69, pl. 8, figs. 2*a–b*). Witt says of it "Errinert in der Form an *Tri. formosum* var., Bright (Micro. Journ., vol. 4, p. 274, pl. 17, fig. 8). Kann aber nicht mit demselben vereint werden da die zellige Struktur von *Tri. formosum* (1) viel feiner, (2) nicht so deutlich radiirend ist." Perhaps the Schmidt figure represents a quadrate form of *T. formosum* Brightwell. All these belong to what we may call the *T. arcticum* Brightwell group, including *T. antarcticum* Janisch, and some diatomists would group them under that name. After a careful examination of *T. arcticum* *T. formosum* Brightwell and this new species, numberless specimens of all these being available in Philippine Islands material, I have come to the conclusion that there are three well defined types which it would be much better to hold as separate species. They are: (1) *T. diaphanum* Mann, as above, the markings of which are very delicate, composed of radiating rows of minute beads, and having at the center an evident cluster of small spines. (2) *T. formosum* Brightwell, more coarsely marked with a hexagonal radiating network, with no central spines but generally having a slightly depressed central area in which the markings are imperfectly formed beads or blotches; well illustrated under that name in Schmidt's Atlas, plate 79, figures 2–3. The network is much finer than that of the next, and is never or rarely filled with a secondary set of markings consisting of minute beads appearing as a ring within each of the areolations, as is always the case in the following: (3) *T. arcticum* Brightwell, much coarser, with secondary internal beading within or, as a matter fact, beneath the areolation, the center of the valve generally having a minute hyaline space (Schmidt, Atlas, pl. 79, figs. 5–8, and pl. 81, figs. 3–4).

As the old genus *Triceratium* is a hopeless complex of disassociated forms, chiefly Biddulphiae, I see decided advantage in accepting Cleve's suggestion of placing in the genus *Trigonium* that residue of *Triceratium* which is *Biddulphioid*, but entirely destitute of the horns or other processes at the angles, a salient characteristic of the true *Biddulphia*. Most members of *Trigonium* are uniformly triangular; a few, like the above, show occasional specimens with four or more angles.

In this connection it is interesting to consider the statement of Castracane in the Report of the Challenger Expedition, page 113, that "we can not believe that the same species can assume sometimes one form and sometimes another, or that from the same *Stictodiscus* sometimes discord and sometimes triangular or polygonal forms arise." The first half of this statement is not true; nor is the other half true, unless he means by "the same *Stictodiscus*" the same *individual.* In that case it evidently is true; for the usual method of diatom multiplication always results in the new individual having one old valve of the parent frustule and one new valve. Consequently no biangular, quadrate, or polygonal new valve could match up with a triangular old valve, and any deviation in the number of sides or angles would be impossible. But the same species with two, three, four, or more sides is so common that every diatomist is familiar with the fact. Thus in some of the Pacific Ocean dredgings examined for my paper on Diatoms of the Albatross Voyages the triangular and quadrate forms of *Biddulphia favus* (Ehrenberg) Van Heurck were both extremely abundant. It is easy to understand the change from a triangular to a quadrate or pentagonal form if we remember that in the auxosporial method of reproduction we have all the necessary conditions for this modification of contour without the loss of those other factors on which depend the species' true characteristics. It was the failure to take this into account that misled Ehrenberg into giving over one hundred specific names to the same species *Actinocylus ehrenbergii* Ralfs, and that lured De Toni into the muddle of splitting up several clearly defined species and grouping them in two impossible genera, *Amphitetras* and *Amphipentas*, according as individual specimens happened to have four or five angles. (See De Toni, Syl. Alg., p. 911.) And as a triangular or other angled form of a species starting out from its auxoporial original would retain that form in all its subsequent multiplications by fission, we see the reason why some one of these is often abundant at a particular place in excess of, or even to the exclusion of, the others. Thus in the case here considered, the quadrangular phase shown in the illustrations is more frequent in the Philippine Islands than the triangular or pentagonal forms. The same is true in the case of *T. bicoronatum* where, as already stated, the generally rare biangular form outnumbers the triangular.

Type.—Cat. No. 43694, U.S.N.M.

TRIGONIUM DISSIMILE (Grunow) Mann

(Schmidt, Atlas, pl. 81, fig. 5.)

See under *T. latum.*

TRIGONIUM DULCE (Greville) Mann

(Micro. Journ., 1866, p. 9, pl. 2, fig. 20.)

The type came from a fossil deposit at Barbados.

TRIGONIUM EULENSTEINII (Grunow) Mann

Plate 37, fig. 4; plate 38, figs. 1, 2, 3.

(Schmidt, Atlas, pl. 75, figs. 6–7; pl. 81, fig.13.)

Triceratium eulensteinii GRUNOW, Schmidt, Atlas, pl. 75, figs. 6–7.

Stictodiscus eulensteinii (Grunow) CASTRACANE, Chall. Exp., p. 116.

Triceratium portuosum JANISCH, Schmidt, Atlas, pl. 81, fig. 13; *T. eulensteinii*, var. *inornata* A. Schmidt.

Stictodiscus bicoronatus CASTRACANE, Chall. Exp., p. 120, pl. 6, fig. 5; pl. 13, fig. 2.

Stictodiscus radfordianus CASTRACANE, Chall. Exp., p. 118, pl. 17, fig. 10,

Stictodiscus anceps CASTRACANE?, Chall. Exp., p. 116, pl. 1, fig. 5.

Triceratium multiplex JANISCH, Schmidt, Atlas pl. 75, fig. 1; pl. 81, fig. 14.

Stictodiscus multiplex (Janisch) CASTRACANE, Chall. Exp., p. 116.—TRUAN and WITT, Diat. Hayti, p. 21 pl. 5, fig. 7.

Triceratium (*Biddulphia*) *heteroporum* GRUNOW, Van Heurck, Synopsis, pl. 112, fig. 2.

Triceratium galapagense CLEVE, New and Little Know Diat., p. 25, pl. 6, fig. 72.

Through the good fortune of having a large number of gatherings from the Philippine Islands in which nearly all the above are more or less abundant I have been able to compare these apparently diverse forms. I find they are unquestionably only differently shaped phases of the same general type represented by *Triceratium eulensteinii* Grunow. It is very possible that *Stictodiscus anceps* Castracane and the second figure of *Stictodiscus bicoronatus* Castracane in the Report of the Challenger Expedition, plate 13, figure 2, may together represent a second closely allied group. I have not seen a sample of *T. heteroporum* Grunow, which comes from fossil St. Monica material; but judging from the illustration in Van Heurck's Synopsis, plate 112, figure 2, unfortunately without description, it is specifically identical with Castracane's *Stictodiscus bicoronatus*. The most aberrant example of this group is the biangular form here illustrated, which is rather abundant in the Philippine Islands. Such biangular forms of normally triangular diatoms are not at all uncommon; as for example, the biangular form of *Entogonia davyana* Greville, called "*Heibergia barbadensis*" Greville, and the biangular form of *Trigonium arcticum* (Brightwell) Cleve, called *Biddulphia balaena* (Ehrenberg), var. *arctica*. All the diatoms named with the present species have certain peculiarities in common and which also distinguish them from other diatoms. They are marked with small but strong beads, rather loosely dispersed except near the margin of the valve, where they are more closely set and arranged in definite rows at right angles to the edge; at the angles of the valve, whether two or many, the beading is smaller, more compact, and is arranged somewhat fanwise. In the center of each of the larger beads is a minute dot or prickle, and where this is prominent the bead is elongated radially as to the center of the valve and the central prickle seems to divide it into twin halves.

This is usually observable in *T. multiplex, Stictodiscus radfordianus, Stictodiscus bicoronatus,* and the unnamed biangular form here figured, and is very evident in my photograph of the triangular *T. bicoronatum* (Castracane) Mann. It would seem to be evident also in *T. heteroporum* Grunow, judging from the Van Heurck figure. In addition to the beading, the surface of the valve is more or less covered with very fine puncta that give to it a dusty appearance, but which is absent in a little ring around each of the beads. This is very generally seen in *Stictodiscus bicoronatus* and is so noted and figured by Castracane; in *T. multiplex,* as represented in Schmidt's Atlas, plate 75, figure 1, and plate 81, figure 14, in my photograph of *Stictodiscus bicoronatus* and in *Triceratium heteroporum,* because of which the latter specific name was selected. Traces of this dusty spattering are also more or less observable in *T. eulensteinii* and *Stictodiscus radfordianus.* There are two other specific marks that are more inconstant; one is a single or double rosette of beads or lines at the center. It is generally prominent in *T. eulensteinii* (Schmidt, Atlas, pl. 75, figs. 6–7), but is sometimes lacking (pl. 81, fig. 13) a phase called for this reason var. *inornata.* In *T. multiplex* it is frequently obscure or absent, but is strongly marked in Schmidt's Atlas, plate 75, figure 1, and dimly so in Schmidt's Atlas, plate 81, figure 14. In the biangular form it is usually conspicuous, sometimes a single ring, sometimes a double one. It is very evident in *T. heteroporum* as a single ring, in *Stictodiscus bicoronatum* as a double ring, whence the name. It is lacking in *T. galapagense* Cleve. The other inconstant factor is the set of watery radiating lines, sometimes straight and sometimes anastomosing. They are usually quite strong in *T. eulensteinii.* This is the case in Schmidt's Atlas, plate 75, figure 6; but in plate 75, figure 7, they are more indistinct and even more so in plate 81, figure 13. In Castracane's type figure of *St. bicoronatus,* Challenger Expedition, plate 6, figure 5, they are evident; but in his second figure, plate 13, figure 12, they are wholly wanting. In Castracane's figure of *St. radfordianus,* Challenger Expedition, plate 17, figure 10, they are rather dim, but in my specimens of this form from the Philippine Islands they are very strong. They are also well marked in *T. galapagense* Cleve. I have never found more than mere traces of them in the biangular form here figured. No hint of them is given in Van Heurck's figure of *T. heteroporum* Grunow.

It will be seen from the forgoing that we have here a group of diatoms well defined from the species outside of the group, but with no constant mark of distinction between each other. Nevertheless, we find the name *eulensteinii* given to such specimens as have an undulate margin, *radfordianus* to such polygonal forms as have practically straight sides and slightly protruded angles, *multiplex* to those with straight sides but not protruded angles, *bicoronatus* to triangular forms with double central rosette, *heteroporum* to triangular forms with single central rosette, *galapagense* to triangular forms with no rosette, and finally the unnamed biangular form here illustrated, showing all the characteristics of the others except the radiating watery lines that are generally but not always present in some of them. As to whether or not these so-called species should be retained for the greater convenience of future identifications depends wholly on what one considers a diatom species to be. I have decided to leave these specific names in my list of Philippine diatoms, as offering better facilities for references to illustrations in other works, but with the above-expressed opinion that they are in reality only varied phases of *T. eulensteinii* Grunow.

As to the confusion caused by some authors assigning these forms to *Trigonium* (that is to say, the old *Triceratium*) and others to *Stictodiscus*, a study and comparison of a liberal number of specimens, examined in both valve and girdle aspect, will convince anyone that Grunow, Van Heurck, Janisch, Cleve, and Schmidt are correct in their original assignments to *Triceratium*, rather than to *Stictodiscus*. It is probable that the watery radiating lines running from the margin toward the center of the valve in some of the foregoing specimens are responsible for their being classified under *Stictodiscus*, that genus being characteristically marked with such lines. But *Stictodiscus* always has a distinct border or rim, well defined and differently marked from the rest of the valve, corresponding to the rim of *Arachnoidiscus*, the genus with which *Stictodiscus* is most closely affiliated. No such rim exists in any of the forms here under consideration. It is true that something like a rim appears in some of the illustrations here referred to; but in every case it is an illusion due to the appearance of the beading at the edge of the valve, where it bends downward toward the girdle, and a slight change of focus of the microscope will quickly dissipate this false impression. A girdle view even more clearly shows there is no trace of a rim; and the whole structure of the diatom seen in that aspect is so utterly unlike *Stictodiscus* that no doubt remains. Such a view of a typical triangular "*Stictodiscus bicoronatus*" Castracane, plate 37, figure 4, of this report, will make clear the true structure.

It may be added that the attempt to avoid the unsatisfactory classification of *T. eulensteinii* as a *Stictodiscus* by referring it and some of these other forms to *Pseudo-Stictodiscus* is most unfortunate; so also Van Heurck's suggestion of its being a *Biddulphia* (Treatise, pp. 466, 468). The type species of the former is *Pseudo-Stictodiscus angulatus* Grunow (Schmidt, Atlas, pl. 74, figs. 24–30), a diatom that has no relationship with the present forms. H. H. Chase, (New and Little-known Diat., p. 6) remarks upon the transfer of *T. eulensteinii* into *Pseudo-Stictodiscus*. "This splitting of well-established genera to accommodate one or two species that happen to vary slightly in size, locality, or outline is to be seriously deprecated; and can but result in confusing students and in bringing certain discredit upon those who make it their business to create new genera and species from insufficient material."

TRIGONIUM FORMOSUM (Brightwell) Cleve

(Schmidt, Atlas, pl. 79, fig. 4; Micro. Journ., 1856, pl. 17, fig. 8.)

For a discussion of the validity of this species and its separation from *T. arcticum* Cleve see under *T. diaphanum.*

TRIGONIUM FRAUENFELDII (Grunow) Mann

(Schmidt, Atlas, pl. 94, fig. 13; Van Huerck, Synopsis, pl. 110, fig. 10.)

There is doubt if this can be held as anything more than a variety of *T. latum* Greville. My specimen agrees exactly with Schmidt's figure, somewhat less with that of the type figure in Van Heurck's Synopsis.

TRIGONIUM GEMINUM (A. Schmidt) Mann

(Schmidt, Atlas, pl. 80, fig. 16.)

This has rather disturbing affinities with that group of diatoms figured on plate 80 of Schmidt's Atlas, with *T. gibbosum* as its type, and for the accommodation of which Bailey himself proposed the genus *Lampriscus.* Bearing on the suggestion, not universally accepted by diatomists, see De Toni (Syl. Alg., p. 1136). The present species is not manifestly a member of this group and a discussion of the necessity for *Lampriscus* is therefore not attempted.

TRIGONIUM HETEROPORUM (Grunow) Mann

(Van Heurck, Synopsis, pl. 112, fig. 2.)

See under *Trigonium bicoronatum* (Castracane) Mann for a discussion of these species.

TRIGONIUM INELEGANS (Greville) Mann

(Schmidt, Atlas, pl. 128, fig. 3.)

The specimen found agrees exactly with Schmidt's figure, to which Grunow gives the varietal name *micropora,* but is rather wide from Greville's type illustration (Micro. Journ., 1866, pl. 2, fig. 21). Neither of these should be confused with *T. punctatum* Brightwell, which they superficially resemble.

TRIGONIUM INGLORIUM (Greville) Mann

(Micro. Journ., 1865, pl. 9, fig. 18.)

This seems to be a strictly Philippine Islands diatom, the type having come from Manila.

TRIGONIUM LATUM (Greville) Mann

(Micro. Journ., 1865, pl. 9, fig. 20; Schmidt, Atlas, pl. 77, figs. 38–39.)

This species is quite variable. An unimportant variety, despite its assertive name, is Grunow's *T. dissimile* in Schmidt, Atlas, plate 81, figure 5. So also another form found at the Philippine Islands and named *T. zonulatum* Greville in Schmidt's Atlas, plate 77, figure 33. It may be added that varieties of these two do approach closely.

TRIGONIUM MEMBRANACEUM (Cleve) Mann

(Cleve, W. I. Diat., p. 20, pl. 5, fig. 33; Peragallo, Diat., France, pl. 105, figs. 4–5.)

This species could be classified as a small and very delicate variety of *Trigonium balaena* (Ehrenberg) Cleve, which see. But in addition to its much more fragile structure, the minute beading of its valves is made up of closely set circular beads, so spaced as to produce a quincunx pattern; while those of *T. balaena* are set in more widely spaced rows and are oval. De Toni and others unite this with *B. titania* Grunow, the type figure of which is given in Van Heurck's Synopsis, plate 95bis, figures 6–9, from which it differs in the character of its girdle and in the absence of the remarkable curved row of prominent beads marking the valve at either end of the oval of *B. titania.* These curious markings favor the idea of placing *B. titania* in the genus *Janischia.* My Philippine specimens are unique in being three-angled instead of two-angled.

TRIGONIUM MULTIPLEX (Janisch) Mann

(Schmidt, Atlas, pl. 75, fig, 1.)

For a discussion of the essential unity of this and *T. eulensteinii* (Grunow) Mann, see the latter.

TRIGONIUM PARDUS (A. Schmidt) Mann

(Schmidt, Atlas, pl. 79, fig. 15.)

Rather close to *T. punctatum.* Schmidt's type came from N. Celebes.

TRIGONIUM PUNCTATUM (Brightwell) Mann

(Micro. Journ., 1856, pl. 17, fig. 18; Schmidt, Atlas, pl. 76, figs. 19–20; pl. 81, figs. 6–7.)

That this is only a variety of the earlier named *T. sculptum* Shadbolt is discussed in my Diatoms of the Albatross Voyages, page 295. It is rather common in the Philippine Islands dredgings and is named separately merely for convenience of reference, a plan here adopted in other similar cases.

TRIGONIUM QUINQUELOBATUM (Greville) Cleve

(Micro. Journ., 1866, p. 83, pl. 9, fig. 21; Schmidt, Atlas, pl. 79, fig. 8.)

Although I am disposed to agree with Grunow, quoted in the above reference to Schmidt's Atlas, that this is a pentagonal form of *T. arcticum* Cleve, and have so recorded in my Diatoms of the Albatross Voyages, page 291, the arrangement is open to objection. It is worth while to note here that typical specimens of *T. arcticum* are common in Philippine Islands material and all show the characteristic cluster of small beads within each hexagon of the network, but no trace of a central papilla in the hexagons, or at most a bright spot in the center due to the absence of beads at that point. In contrast to this, *T. quinquelobatum*, less common but not scarce, has a strong papilla in the middle of each hexagon with no trace of the underlying beading so evident in *T. arcticum*. There is an unmistakable contrast between the two, both with low magnification and under immersion objectives.

TRIGONIUM RADFORDIANUM (Castracane), Mann

(Castracane, Chall. Exp., pl. 17, fig. 10.)

For a discussion of the essential unity of this and *T. eulensteinii*, see under the latter.

TRIGONIUM (TRICERATIUM) RADIOLATUM Janisch

See under *Cestodiscus radiolatus*.

TRIGONIUM SCULPTUM Shadbolt

(Micro. Journ., 1854, p. 15, pl. 1, fig. 4; Schmidt, Atlas, pl. 76, figs. 9–10.)

As stated above, under *T. punctatum*, that diatom is a variety of this one. De Toni (Syl. Alg., p. 944) unites them, but under Brightwell's later name (1856), and then confuses the two with *T. reticulum* Brightwell (1853), following Cleve's mistake in his Diatoms from the West Indian Archipelago, page 16. Van Heurck (Synopsis, pl. 109, figs. 7–8) names it *T. sculptum*, but figures Brightwell's varietal form *T. punctatum*, which lacks the three rings on which Shadbolt's name was based and which are well shown in the above references. He further implies that the species is really a *Biddulphia*, from which I dissent, there being no processes at the angles.

TRIGONIUM ZONULATUM (Greville) Mann

(Schmidt, Atlas, pl. 77, fig. 33.)

There is a doubt of the Philippine Islands form belonging to this species. It is exactly figured as above, but it might perhaps better be considered to be a small triangular example of *T. latum* Greville. The statement made under the latter, that the two are often approximately alike, may be here repeated.

Genus TRINACRIA Heiberg

The species classified under this name are generally recognized to be merely triangular phases of the genus *Hemiaulus* (Ehrenberg) Grunow. They are principally found in fossil deposits, notably those at Mors, Denmark, and Simbirsk, Russia. A coarse, blotchy style of marking and stiff, straight processes tipped with stout spines that rise vertically from the angles of the valves are equally characteristic of both, the processes being two on the biangular *Hemiaulus* and three on the triangular *Trinacria*. Van Heurck makes this essential unity clear by figures in Van Heurck's Treatise, page 456. He there also adds to *Hemiaulus* a quadrate phase for which Heiberg created the genus *Solium* and an unsymmetrical biangular phase for which Heiberg created the genus *Corinna*. How that diatomist could separate generically such evident examples of *Hemiaulus* as the last is a mystery.

But *Trinacria* has at least one quality that is favorable to its retention as a convenient division of diatom taxonomy—the fact that these triangular forms are very rarely or never anything but triangular; that is to say, do not vary into the typical biangular *Hemiaulus* phase, and can therefore never be confused with strict *Hemiaulus* species. In the superficially similar genus, *Trigonium*, and especially in the old conglomerate *Triceratium*, two, three, four, five, or more angled modifications of the type form are common. But the persistent triangular shape maintained by the 30 or more species of *Trinacria* makes their retention in a group a material help in identification. I therefore retain this generic name, subject to the foregoing statement of agreement with H. L. Smith, Grunow, Van Heurck, and other diatomists, who have carefully considered this subject.

TRINACRIA LIMPIDA, new species

Plate 39, fig. 1

This species resembles rather closely two examples of *T. wittii* A. Schmidt figured in Schmidt's Atlas, plate 96, figure 1, and plate 97, figure 2, and the phase of the same thing accepted as such by Schmidt and figured in Witt's Diatoms of Simbirsk, plate 11, figure 1. But the Philippine specimens have undulating sides, delicate lines radiating from a central rosette, on which are strung widely separated beads, as on threads; a strongly contrasting single row of large, oval beads along the margin, and with decidedly rounded apices marked with minute, closely set beading arranged fanwise; in all of which it contrasts with *T. wittii*, especially with the latter's produced and apiculate apices. In fact, there is less doubt of the separateness of these two than the wisdom of calling either of them anything more than wide varieties of *T. regina* Heiberg.

Diameter of valve, from apex to middle of opposite side, 0.107 mm.

Type.—Cat. No. 43695, U.S.N.M.

TRINACRIA TRIPEDALIS, new species

Plate 39, figs. 2–3

Valve triangular, with blunt, rounded apices, the verticle legs at the three angles appearing in this view as three oval or subtriangular disks, each showing a shadowy internal ring, but otherwise hyaline; exclusive of these, the valve is ornamented with small widely separated beads, set in four concentric circles, with large, elongated, equidistant beads or bars along the three sides of the valve; in side (girdle) view the beading of the valve is seen to extend downward toward the girdle only one or two rows, being followed by a hyaline space, with a single row of beading on its edge where it joins the girdle; the latter is beaded with closely set transverse lines; the vertical legs are short, stout, rounded, and marked with scattered beading, their terminal awns three parted.

Height of valve measured from apex to middle of opposite side, 0.037–0.047; width of frustule, 0.039 mm. (average).

There is marked similarity between this and some figures of so-called *Triceratium*, as *T. pauperculum* Greville (Trans. Micro. Soc., 1865, pl. 6, fig. 26) and *T. dulce* Greville (Trans. Micro. Soc., 1866, pl. 2, fig. 20), but as only a side (girdle) view can indicate their true generic position, a union of this merely similar form with them would be unwise.

Type.—Cat. No. 43696, U.S.N.M.

Genus TROPIDONEIS Cleve

The diatoms included in this genus were weeded out of *Amphiprora* by Cleve. I believe they form a valid genus and relieve *Amphiprora* of some species resembling true *Amphiproras* in only a general way. Cleve defines and gives reasons for this genus in his Naviculoid Diatoms, part 1, page 22. Van Huerck in his treatise, page 263, accepts the genus and its three subdivisions *Orthotropis*, *Plagiotropis*, and *Amphoropsis*.

TROPIDONEIS APPROXIMATA Cleve

(Cleve, Nav. Diat., vol. 1, p. 26, pl. 3, figs. 20–21.)

TROPIDONEIS FRAGILIS (Tempère and Brun) Mann

(Brun, Diat. Jap., pl. 9, fig. 14.)

This is rather close to *Amphiprora membranacea* (Cleve, Diat. Java, pl. 2, fig. 18), renamed *Tropidoneis membraneacea* by Cleve, in his Naviculoid Diatoms (vol. 1, p. 24).

TROPIDONEIS JAVANICA (Cleve) Mann

(Cleve, Nav. Diat., vol. 1, p. 21, pl. 2, fig. 22.)

Cleve puts this in the genus *Auricula*. After carefully examining several specimens I can find no justification for this. The geographical proximity of the type location, Java, to the Philippine Islands is to be noted.

TROPIDONEIS LATA Cleve

(Cleve, Nav. Diat., vol. 1, p. 28, pl. 3, figs. 3–4.)

TROPIDONEIS LEPIDOPTERA (Gregory) Cleve

(Micro. Journ., 1857, pl. 1, fig. 39; Gregory, Diat., Clyde, pl. 12, fig. 59.)

TROPIDONEIS MAXIMA (Gregory) Cleve

(Gregory, Diat., Clyde, pl. 12, fig. 61.)

TROPIDONEIS MEMBRANACEA Cleve

(Cleve, Diat., Java, pl. 2, fig. 18; Cleve, Nav. Diat., vol. 1, p. 24.)

Note the resemblance to this mentioned under *T. fragilis*.

TROPIDONEIS OBLONGA (Greville) Cleve

(Micro. Journ., 1863, pl. 1, fig. 15.)

Cleve says (Nav. Diat., vol. 1, p. 26) that this "seems to be akin to *T. maxima*." If this means they are specifically the same, the specimens I have do not uphold that supposition. There is enough difference between them to justify both names.

TROPIDONEIS PHANTASMA, new species

Plate 39, fig. 4

Valve extremely convex and laterally compressed, so that the view obtained is always that of the side (girdle), the rhaphe occupying the sharp curved ridge of the dorsal side; the two halves on either side of the rhaphe are of unequal width, so that, seen from the side, one overlaps the other, the edge of the wider appearing to be convex and that of the narrower slightly concave; the rhaphe is strong, the central nodule (in middle of the dorsal ridge) somewhat depressed; the two terminal nodules are located at the extreme tips of the pointed apices; markings of transverse lines of very fine closely set beading, frequently interrupted by hyaline spaces, giving to the valve a decidedly mottled appearance. This species is rare.

Length of valve, 0.148; depth of valve, 0.056; lines 17.2 in 0.01 mm.

Type.—Cat. No. 43697, U.S.N.M.

TROPIDONEIS VAGA, new species

Plate 39, fig. 5

Valve lanceolate, at its middle barely constricted laterally but deeply depressed transversely with tapering, somewhat cuneiform ends and rounded apices; an elevated longitudinal median area, one-third the width of the valve, extending from the center to the two apices; rhaphe strong, straight, its halves terminating at both ends in beads, the central ends well separated; the markings are of closely set, coarse, transverse, beaded lines; there is a small hyaline space at the central nodule, and a slight separation of the lines on either side of this, giving a suggestion of a stauros; in girdle view the two convex halves are seen to be separated by the deep median sinus.

Length 0.143; width 0.019; lines 10 in 0.01 mm.

This diatom because of its median ridge and its coarse beading resembles *Navicula carinifera* Grunow, except for its linear shape, median constrictions, and tapering ends. It has some likeness to *T. lepidoptera* (Gregory) Cleve, but its very coarse beading in proportion to its size and its *Achnanthes*-like constrictions at the middle sufficiently separate them. In this last respect it reminds one of "*Achnanthes pennaeformis*" Greville (Diat. So. Hemi., pl. 6, figs. 11–13). The specific name here given refers to the confusing qualities, which seem to link it to *Navicula*, to *Tropidoneis*, and to *Achnanthes*. It is rare.

Type.—Cat. No. 43698, N. U.M.S.

Genus WILLEMOESIA Castracane

This genus, created by Castracane in his Report of the Challenger Expedition, page 165, is not clearly described, although the first of his three figures in plate 8 make sufficiently plain the nature of the single species so far known. Rattray (Rev. Cosc., p. 452) rejects this genus and names the diatom *Coscinodiscus humilis* Rattray. It is a serious stretch of the boundary of *Coscinodiscus* to include this form, and the finding of three specimens in three separate dredgings from the Philippine Islands shows we have to do with a persistent and well-marked diatom. Van Heurck in his treatise, page 537, accepts this genus.

WILLEMOESIA ELONGATA (Grunow) Mann

(Castracane, Chall. Exp., pl. 8, fig. 8; not 8*a*–8*b*; Van Heurck, Synopsis, pl. 125, figs. 14–17; Van Heurck, Treat., p. 537, fig. 284.)

The two figures of Castracane's excluded above are suspiciously like nondiatom plates frequently met with, one of which is well illustrated in the same work, plate 10, figure 10. In no other figures nor in the specimens I found are the borders hyaline, as they are in these plates. They are also perfectly flat, not convex like the present species. Rattray's specific name, *humilis*, should be rejected in favor of the earlier *Coscinodiscus elongatus* of Grunow (1880), which is unquestionably the same diatom. As to the figures in Van Heurck's Synopsis, which with some question he places in *Actinocyclus*, it is *a priori* evident these unique specimens are suspiciously alike; and as for the "pseudonodule" because of which Van Heurck with doubt assigns them to *Actinocyclus*, I am of the opinion that the dot seen by Van Heurck is not a true pseudonodule, one of my specimens having *three* such dots on one valve and *none* on the other valve of the same frustule. I shall therefore assume, for the present, that we are here dealing with a single species.

EXPLANATION OF PLATES

PLATE 1

		Page
Fig. 1.	*Achnanthes cocconeiformis*, new species. ×580	10
2.	*Achnanthes compacta*, new species. ×970	10
3.	*Achnanthes tenuistauros*, new species. ×600	11
4.	*Achnanthes tenuistauros*, new species. ×600	11
5.	*Achnanthes tenuistauros*, new species. ×590	11
6.	*Achnanthes tenuistauros*, new species. ×590	11
7.	*Actinocyclus bipartitus*, new species. ×790	12
8.	*Actinoptychus parvus*, new species. ×930	15

PLATE 2

		Page
Fig. 1.	*Actinocyclus decussatus*, new species. ×570	12
2.	*Actinocyclus decussatus* (type). ×825	12
3.	*Allonitzschia munifica*, new species. ×570	16

PLATE 3

		Page
Fig. 1.	*Amphiprora limpida*, new species. ×875	16
2.	*Amphiprora o'swaldii* Janisch. ×550	17
3.	*Amphora alternata*, new species. ×400	18
4.	*Amphora anceps*, new species. ×510	18
5.	*Amphora clathrata*, new species. ×600	19
6.	*Amphora compacta*, new species. ×580	19
7.	*Amphora cucumeris*, new species. ×480	20
8.	*Amphora henshawii*, new species. ×760	23

PLATE 4

		Page
Fig. 1.	*Amphora dichotoma*, new species. ×900	21
2.	*Amphora dura*, new species. ×680	22
3.	*Amphora tumulifer*, new name. ×1100	28
4.	*Amphora flexa*, new species. ×590	22
5.	*Amphora lunaris*, new species. ×390	24
6.	*Amphora pauca*, new species. ×390	25

PLATE 5

		Page
Fig. 1.	*Amphora pulchra* Greville. ×690	26
2.	*Amphora recessa*, new species. ×430	27
3.	*Amphora nodosa* Brun, variety. ×590	25
4.	*Amphora magnifica* Greville. ×580	25
5.	*Amphora sima*, new species. ×400	27
6.	*Amphora intersecta* A. Schmidt, variety? ×490	24

PLATE 6

		Page
Fig. 1.	*Anisodiscus adeei*, new species. ×570	28
2.	*Aulacodiscus pretiosus*, new species. ×300	31
3.	*Aulacodiscus recedens*, new species. ×570	31
4.	*Auliscus philippinarum*, new species. ×570	32
5.	*Asteromphalus areolatus*, new species. ×710	30

PLATE 7

Page
FIG. 1. *Auliscus quadratus*, new species. ×550 ---------- 33
2. *Auliscus quadratus*, new species. ×550 ---------- 33
3. *Biddulphia abjecta*, new species. ×600 ---------- 33
4. *Biddulphia abjecta*, new species. ×600 ---------- 33
5. *Biddulphia cingulata*, new species. ×670 ---------- 35
6. *Biddulphia cingulata*, new species. ×500 ---------- 35

PLATE 8

Page
FIG. 1. *Biddulphia cycloides*, new species. ×580 ---------- 37
2. *Biddulphia cornigera*, new species. ×360 ---------- 36
3. *Biddulphia discursa*, new species. ×260 ---------- 37
4. *Biddulphia petitii* (Leuduger-Fortmorel) Mann ---------- 43
5. *Biddulphia fractosa*, new species. ×850 ---------- 39
(*See also* pl. 10, fig. 1.)

PLATE 9

Page
FIG. 1. *Biddulphia exacta*, new species. ×450 ---------- 38
2. *Biddulphia informis*, new species. ×840 ---------- 41
3. *Biddulphia informis*, new species. ×860 ---------- 41
4. *Biddulphia inverta*, new species. ×230 ---------- 41
(*See also* pl. 10, figs. 2–3.)

PLATE 10

Page
FIG. 1. *Biddulphia fractosa*, new species. ×220 ---------- 39
(*See also* pl. 8, fig. 5.)
2. *Biddulphia inverta*, new species. ×150 ---------- 41
3. *Biddulphia inverta*, new species. ×190 ---------- 41
(*See also* pl. 9, fig. 4.)
4. *Biddulphia petitiana*, (Leuduger-Fortmorel)? Mann. ×590 --- 43
5. *Biddulphia petitiana*, (Leuduger-Fortmorel)? Mann. ×650 --- 43
6. *Biddulphia retiforms*, new species. ×840 ---------- 45
7. *Biddulphia rudis*, new species. ×880 ---------- 45
8. *Biddulphia trisinua*, new species. ×290 ---------- 47
9. *Biddulphia trisinua*, new species. ×290 ---------- 47

PLATE 11

Page
FIG. 1. *Biddulphia turrigera*, new species. ×620 ---------- 47
2. *Biddulphia turrigera*, new species. ×570 ---------- 47
3. *Biddulphia undulosa*, new species. ×570 ---------- 48
4. *Campylodiscus bilateralis*, new species. ×500 ---------- 49
5. *Campylodiscus ligulosus*, new species. ×790 ---------- 53
6. *Campylodicus perspicuus*, new species. ×510 ---------- 53
7. *Chaetoceros* (*Bacteriastrum*) *hebes*, new species. ×490 ---------- 56

PLATE 12

Page
FIG. 1. *Chaetoceros* (*Bacteriastrum*) *medusa*, new name. ×470 ---------- 57
2. *Chaetoceros* (*Bacteriastrum*) *medusa*, new name. ×470 ---------- 57
3. *Chaetoceros* (*Bacteriastrum*) *princeps*, new name. ×340 ---------- 57
4. *Climacosphenia scimiter*, new species. ×230 ---------- 59

Plate 13

		Page
Fig. 1.	*Chrysanthemodiscus floriatus*, new species. ×450	58
2.	*Cocconeis circulifera*, new species. ×1350	60
3.	*Cocconeis citronella*, new name. ×820	61
4.	*Cocconeis citronella*, new name. ×820	61
5.	*Cocconeis citronella*, new name. ×820	61
6.	*Cocconeis citronella*, new name. ×820	61

Plate 14

		Page
Fig. 1.	*Cocconeis ocellata*, new species. ×590	63
2.	*Cocconeis os-pristis*, new species. ×1150	63
3.	*Coscinodiscus ciliatus*, new species. ×780	65
4.	*Coscinodiscus nano-lineatus* new species. ×1070	68
5.	*Coscinodiscus scitulus*, new species. ×900	70
6.	*Cyclotella crassilineata*, new species. ×900	71

Plate 15

		Page
Fig. 1.	*Cymatoneis definita*, new species. ×680	72
2.	*Cymatoneis lacunata*, new species. ×820	72
3.	*Cymatoneis sufflata*, new species. ×820	72
4.	*Dimeregramma bilineatum* (Cleve and Grunow) Mann. ×900	73
5.	*Dimeregramma fluens*, new species. ×580	73
6.	*Dimeregramma opulens*, new species. ×590	74
7.	*Dimeregramma opulens*, new species. ×850	74
8.	*Dimeregramma prismaticum*, new species. ×820	74
9.	*Endictya margaritifera*, new species. ×380	75
10.	*Endictya margaritifera*, new species. ×380	75

Plate 16

		Page
Fig. 1.	*Echinodiscus vermiculatus*, new species. ×460	75
2.	*Glyphodesmis acus*, new species. ×850	78
3.	*Glyphodesmis acus*, new species. ×850	78
4.	*Grammatophora fundata*, new species. ×510	78
5.	*Grammatophora fundata*, new species. ×510	78
6.	*Grammatophora probata*, new species. ×600	79
7.	*Grammatophora probata*, new species. ×600	79

Plate 17

		Page
Fig. 1.	*Henshawia biddulphioides*, new species. ×450	81
2.	*Henshawia biddulphioides*, new species. ×500	81
3.	*Hyalodiscus aspersus*, new species. ×670	83
4.	*Hyalodiscus aspersus*, new species. ×670	83
5.	*Hyalodiscus aspersus*, new species. ×1340	83

Plate 18

		Page
Fig. 1.	*Hercotheca inermis*, new species. ×800	82
2.	*Hercotheca inermis*, new species. ×800	82
3.	*Hyalodiscus annulus*, new species. ×970	83
4.	*Hyalodiscus hirtus*, new species. ×830	84
5.	*Hyalodiscus propeplanus*, new species. ×300	84
6.	*Licmophora debyi* (Leuduger-Fortmorel) Mann. ×580	86
7.	*Mastogloia achnanthioides*, new species. ×550	87

PLATE 19

		Page
FIG. 1.	*Mastogloia capax*, new species. ×840	87
2.	*Mastogloia cebuensis*, new name. ×780	88
3.	*Mastogloia fusiformis*, new species. ×760	88
4.	*Mastogloia imitatrix*, new species. ×520	89
5.	*Mastogloia ovata* Grunow. ×900	90
6.	*Mastogloia quinquecostata* Grunow variety. ×860	91
7.	*Mastogloia quinquecostata* Grunow variety. ×820	91

PLATE 20

		Page
FIG. 1.	*Melosira dura*, new species. ×780	92
2.	*Melosira dura*, new species. ×1120	92
3.	*Melosira gowenii* A. Schmidt. ×610	93
4.	*Melosira gowenii* A. Schmidt. ×670	93
5.	*Melsoira incompta*, new species. ×670	93
6.	*Navicula biformis* (Grunow) Mann. ×660	95
7.	*Navicula biformis* (Grunow) Mann. ×660	95

PLATE 21

		Page
FIG. 1.	*Navicula bigemmata*, new species. ×570	95
2.	*Navicula branchiata*, new species. ×830	96
3.	*Navicula caeca*, new species. ×890	97
4.	*Navicula corpulenta*, new species. ×580	99
5.	*Navicula cyclops*, new species. ×580	99
6.	*Navicula durandii* Kitton, variety. ×360	101
7.	*Navicula excavata* Greville, wide variety. ×570	102

PLATE 22

		Page
FIG. 1.	*Navicula funiculata*, new species. ×470	102
2.	*Navicula funiculata*, new species. ×470	102
3.	*Navicula glabrissima*, new species. ×1000	103
4.	*Navicula graeffii* Grunow. ×560	103
5.	*Navicula imitans*, new species. ×590	104
6.	*Navicula imitans*, new species. ×590	104
7.	*Navicula inexacta*, new name. ×800	105
8.	*Navicula ingens*, new species. ×810	105

PLATE 23

		Page
FIG. 1.	*Navicula indigens*, new species. ×610	105
2.	*Navicula inhalata* A. Schmidt, variety. ×390	107
3.	*Navicula mendica*, new species. ×1100	109
4.	*Navicula mimula*, new name. ×950	110
5.	*Navicula molesta*, new species. ×1070	110
6.	*Navicula obesa* (Greville) Mann. ×830 (*See also* pl. 24, fig. 1.)	111

PLATE 24

		Page
Fig. 1.	*Navicula obesa* (Greville) Mann, variety. ×600 (*See also* pl. 23, fig. 6.)	111
2.	*Navicula ocellata*, new species. ×830	112
3.	*Navicula partita*, new species. ×770	113
4.	*Navicula patricia*, new species. ×560	114
5.	*Navicula delecta*, new species. ×510	100
6.	*Navicula delecta*, new species. ×430	100
7.	*Navicula delecta*, new species. ×590	100
8.	*Navicula plicatula* Grunow, typical form. ×810	115
9.	*Navicula plicatula* Grunow, variety. ×810	115

PLATE 25

		Page
Fig. 1.	*Navicula philippinarum*, new species. ×660	114
2.	*Navicula pseudo-clavata*, new species. ×590	116
3.	*Navicula pulvulenta*, new species. ×700	117
4.	*Navicula madagascarensis* Cleve, variety. ×750	108
5.	*Navicula retrostauros*, new species, ×680 (*See also* pl. 26, figs 1–2.)	118

PLATE 26

		Page
Fig. 1.	*Navicula retrostauros*, new species. ×600	118
2.	*Navicula retrostauros*, type. ×610 (*See also* pl. 25, fig. 5.)	118
3.	*Navicula pudens*, new species. ×700	117
4.	*Navicula pugio*, new species. ×840	117
5.	*Navicula semistauros*, new species. ×590	119
6.	*Navicula serrutula* Grunow, variety. ×570	120
7.	*Navicula simulator*, new species. ×590	120
8.	*Navicula spiculifera*, new species. ×840	121
9.	*Navicula translucens*, new species. ×440	123

PLATE 27

		Page
Fig. 1.	*Navicula spectabilis* Gregory. ×310	121
2.	*Navicula spectabilis* Gregory, wide variety? ×450	121
3.	*Navicula suffocata*, new species. ×770	122
4.	*Navicula venusta* Janisch type form. ×820	124
5.	*Navicula venusta*, variety. ×820	124
6.	*Navicula vesparella*, new name. ×820	124
7.	*Navicula weissflogii* A. Schmidt. ×570	125

PLATE 28

		Page
Fig. 1.	*Nitzschia bisculpta*, new species. ×590	125
2.	*Nitzschia bisculpta*, new species. ×590	125
3.	*Nitzschia campechiana* Grunow. ×570	126
4.	*Nitzschia campechiana* Grunow. ×560	126
5.	*Nitzschia cocconeiformis* Grunow. ×570	126
6.	*Nitzschia insignis* Gregory, variety. ×550	127
7.	*Nitzschia zebuana*, new species. ×650	129

PLATE 29

		Page
FIG. 1.	*Plagiogramma antillarum* Cleve. ×790	129
2.	*Plagiogramma attenuatum* Cleve, typical form. ×800	129
3.	*Plagiogramma distinctum*, new species. ×580	130
4.	*Pleurosigma acus*, new species. ×820	132
5.	*Pleurosigma acus*, new species. ×610	132
6.	*Pleurosigma dolosum*, new species. ×610	133
7.	*Pleurosigma exemptum*, new species. ×100	134
8.	*Pleurosigma exemptum*, new species. ×550	134
9.	*Pleurosigma obesum*, new species. ×310	136

PLATE 30

		Page
FIG. 1.	*Pleurosigma falx*, new species. ×850	134
2.	*Pleurosigma obtusum*, new species. ×500	137
3.	*Pleurosigma obtusum*, new species. ×500	137
4.	*Pleurosigma prisma*, new species. ×800	137
5.	*Pleurosigma rigens*, new species. ×480	138
6.	*Pleurosigma suluense*, new species. ×200	139
7.	*Pseudo-Eunotia doliolus* (Wallich) Grunow. ×600	140
8.	*Pseudo-Eunotia doliolus* (Wallich) Grunow. ×600	140

PLATE 31

		Page
FIG. 1.	*Rhabdonema sutum*, new species. ×450	141
2.	*Rhabdonema sutum*, new species. ×450	141
3.	*Roperia tesselata* (Roper) Grunow, ovate var. ×690	143
4.	*Sceptroneis (?) cuneata* Grunow. ×590	144
5.	*Scoliopleura partistriata*, new species. ×760	144

PLATE 32

		Page
FIG. 1.	*Stictocyclus varicus*, new species. ×380	146
2.	*Stictocyclus varicus*, new species. ×400	146
3.	*Stictodiscus nitidus* Grove and Sturt, wide variety? ×450	150

PLATE 33

		Page
FIG. 1.	*Stictodiscus californicus* Greville, malformation. ×490	149
2.	*Surirella bertillonii*, new species. ×910	151
3.	*Surirella continuata*, new species. ×390	153
4.	*Surirella cuneatella*, new species. ×790	153
5.	*Surirella gravis*, new species. ×570	155

PLATE 34

		Page
FIG. 1.	*Surirella concentrica*, new species. ×380	152
2.	*Surirella contigua*, new species. ×440	152
3.	*Surirella foliata*, new species. ×320 (This is from Panama.)	152
4.	*Surirella imitans*, new species. ×820	155
5.	*Surirella macraeana* Greville, wide variety. ×600	156
6.	*Surirella macraeana* Greville, wide variety. ×600	156
7.	*Surirella macraeana* Greville. ×800	156

PLATE 35

		Page
FIG. 1.	*Surirella macraeana* Greville. × 400 (*See also* pl. 34, figs. 5, 6, 7.)	156
2.	*Surirella facilis,* new species. ×470	154
3.	*Surirella fausta* A. Schmidt. ×620	155
4.	*Surirella studeri* Janisch. ×400	158

PLATE 36

		Page
FIG. 1.	*Surirella orientalis,* new species. ×660	156
2.	*Surirella significans,* new species. ×810	158
3.	*Surirella suluensis,* new species. ×470	158

PLATE 37

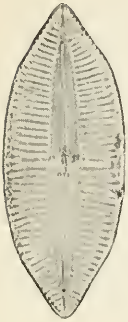
		Page
FIG. 1.	*Synedra pulcherrima* Hantzsch. ×570	159
2.	*Tribrachia pellucida,* new species. ×410	161
3.	*Trigonium diaphanum,* new species. ×410	163
4.	*Trigonium bicoronatum* (Castracane) Mann, ×430 (*See also* pl. 38, figs. 1, 2, 3.)	161

PLATE 38

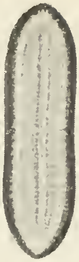
		Page
FIG. 1.	*Trigonium bicoronatum* (Castracane) Mann. ×820	161
2.	*Trigonium bicoronatum* (Castracane) Mann. ×630	161
3.	*Trigonium bicoronatum* (Castracane) Mann. ×800	161

PLATE 39

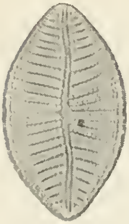
		Page
FIG. 1.	*Trinacria limpida,* new species. ×460	172
2.	*Trinacria tripedalis,* new species. ×900	173
3.	*Trinacria tripedalis,* new species. ×900	173
4.	*Tropidoneis phantasma,* new species. ×450	174
5.	*Tropidoneis vaga,* new species. ×530	174
6.	*Trigonium contumax,* new species. ×780	162



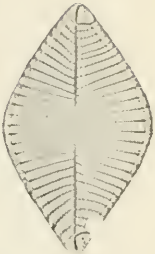
1.



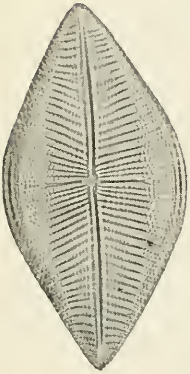
2.



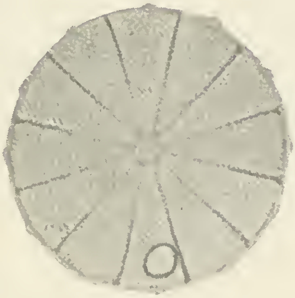
3.



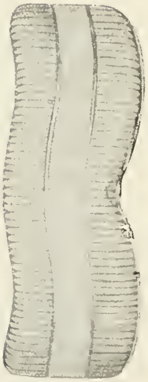
4.



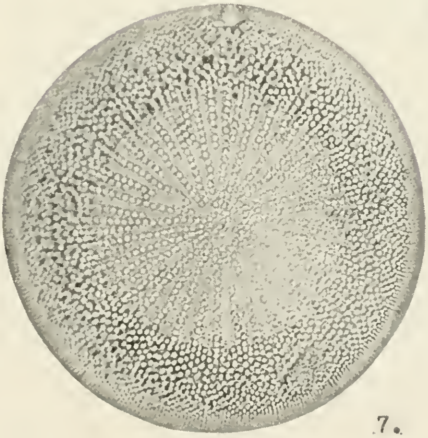
5.



8.



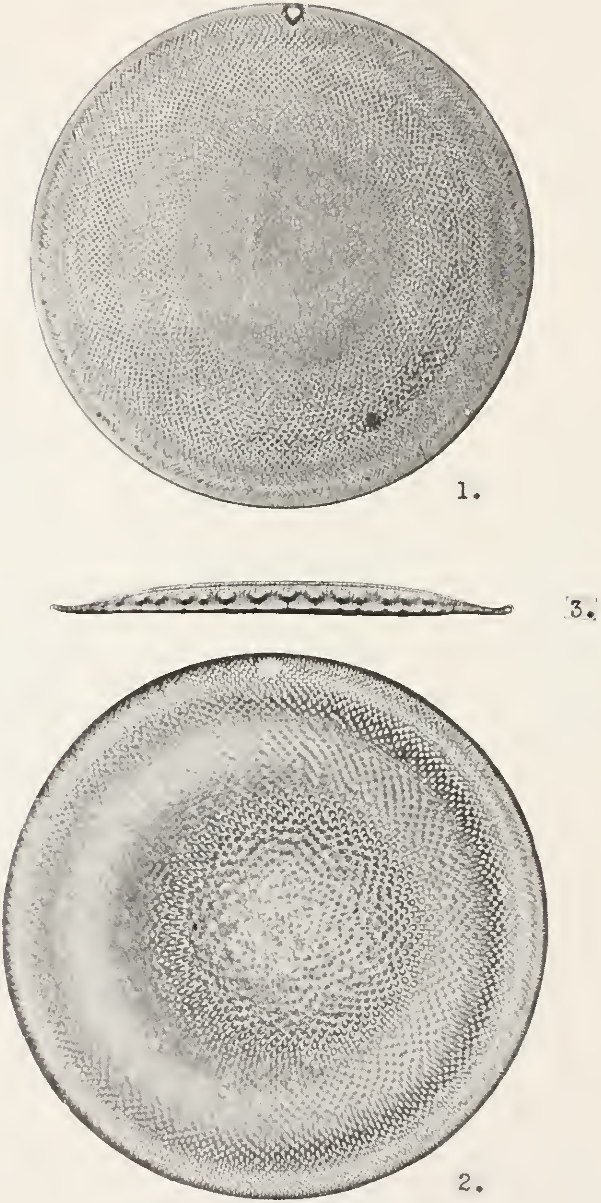
6.



7.

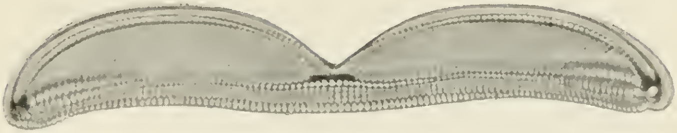
Diatoms of the Philippine Islands

For explanation of plate see page 176

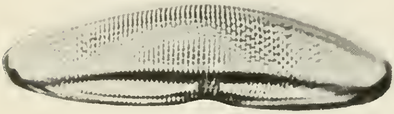


DIATOMS OF THE PHILIPPINE ISLANDS

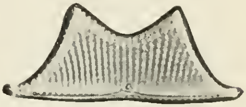
FOR EXPLANATION OF PLATE SEE PAGE 176



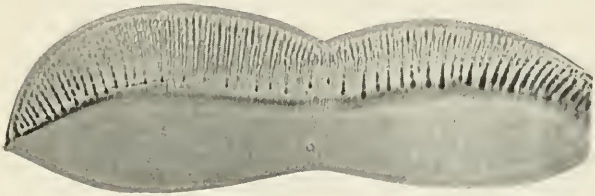
1.



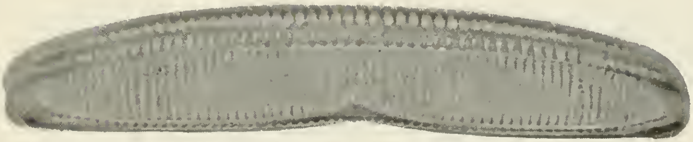
3.



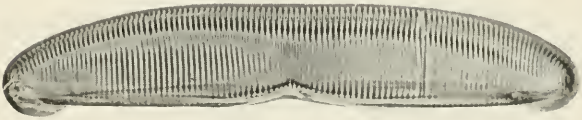
4.



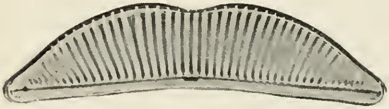
2.



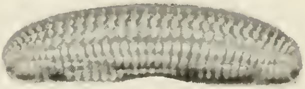
5.



6.



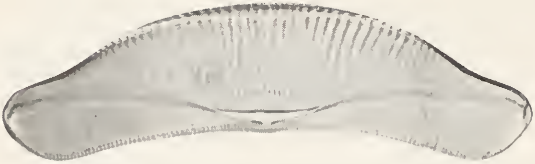
8.



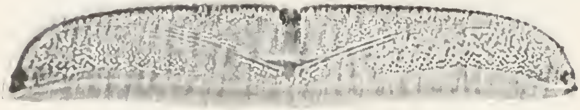
7.

DIATOMS OF THE PHILIPPINE ISLANDS

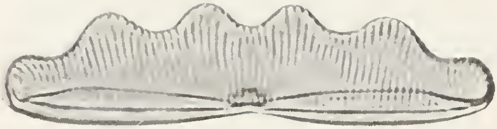
FOR EXPLANATION OF PLATE SEE PAGE 176



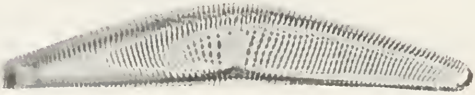
1.



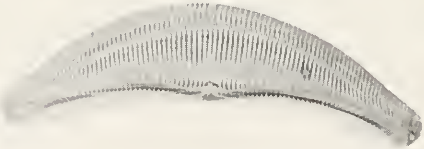
2.



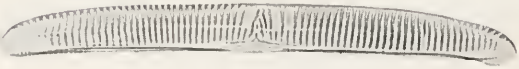
3.



4.



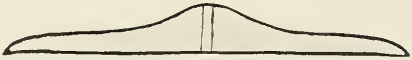
5.



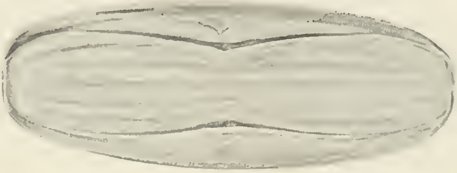
6.

Diatoms of the Philippine Islands

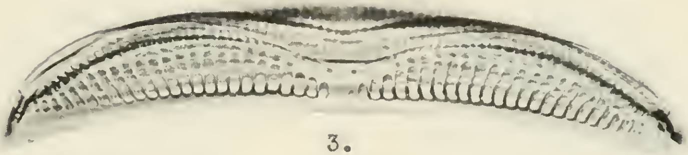
For explanation of plate see page 176



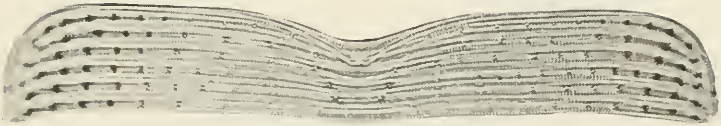
1.



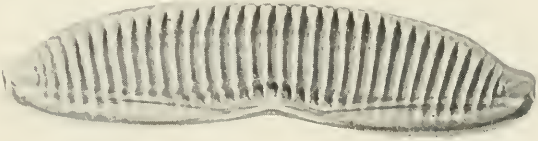
2.



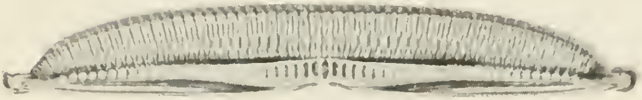
3.



4.



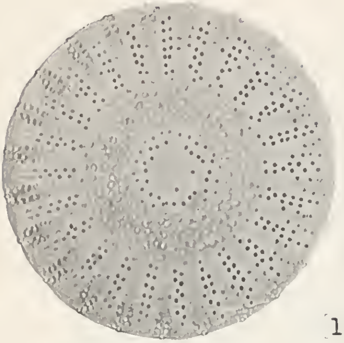
5.

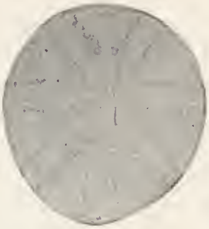


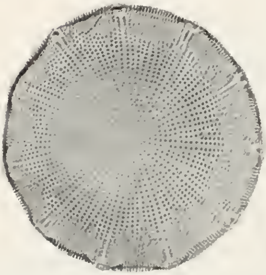
6.

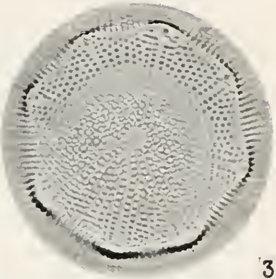
DIATOMS OF THE PHILIPPINE ISLANDS

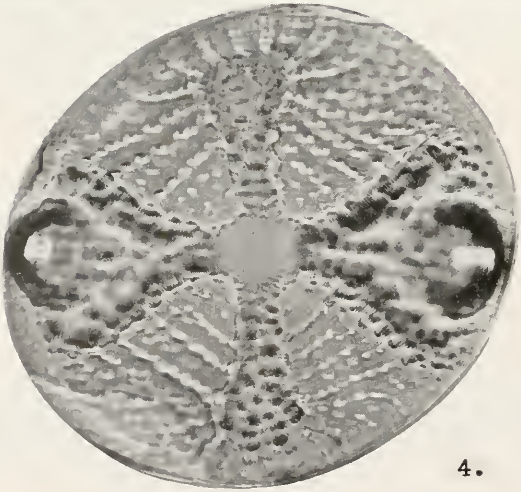
FOR EXPLANATION OF PLATE SEE PAGE 176


1.


5.

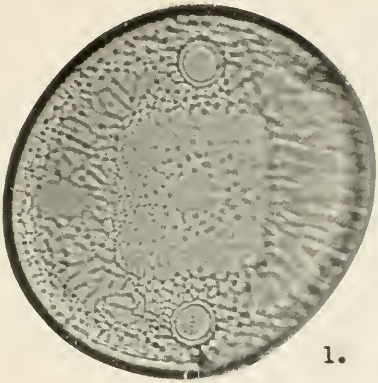

2.


3.

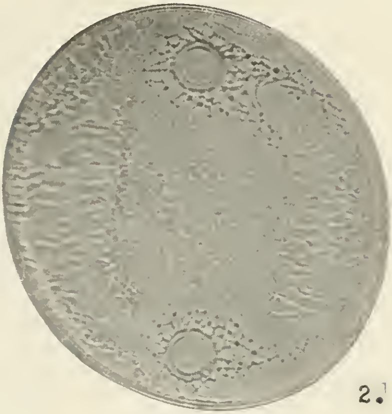

4.

Diatoms of the Philippine Islands

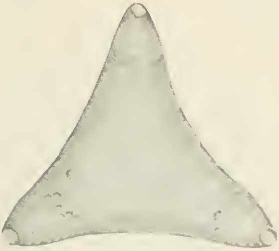
For explanation of plate see page 176



1.

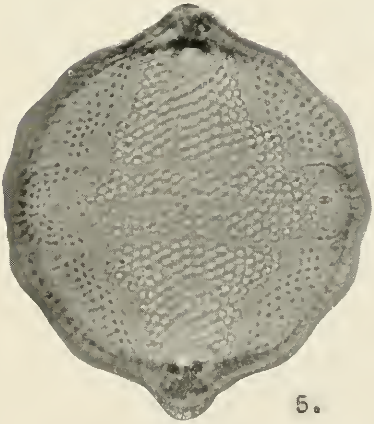


2.

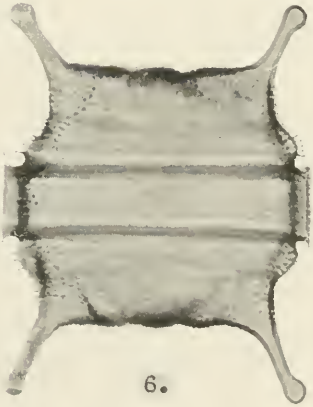


3.

4.



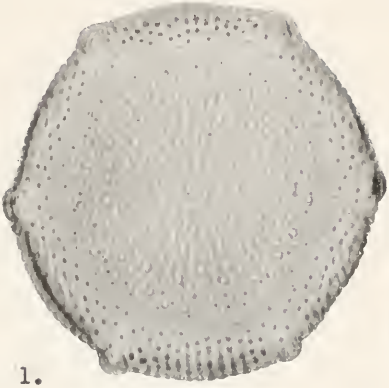
5.



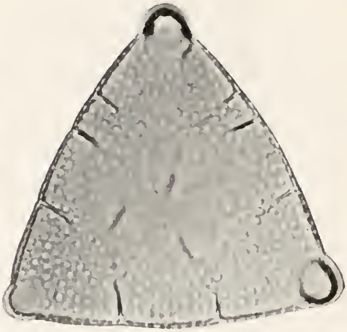
6.

DIATOMS OF THE PHILIPPINE ISLANDS

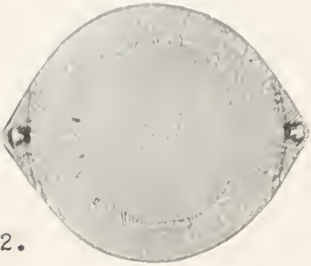
FOR EXPLANATION OF PLATE SEE PAGE 177



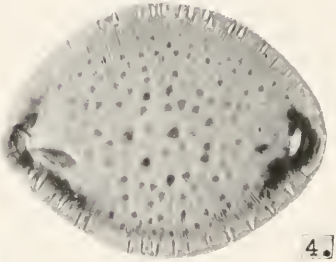
1.



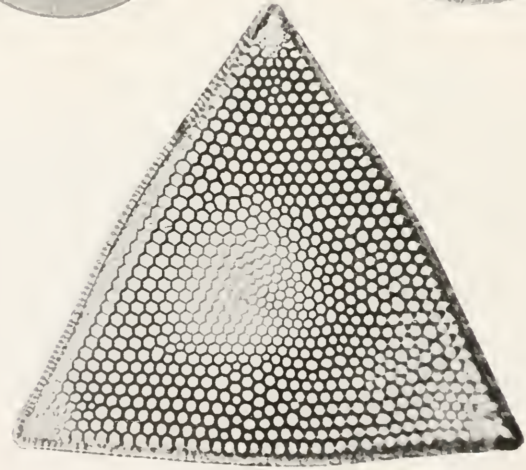
5.



2.



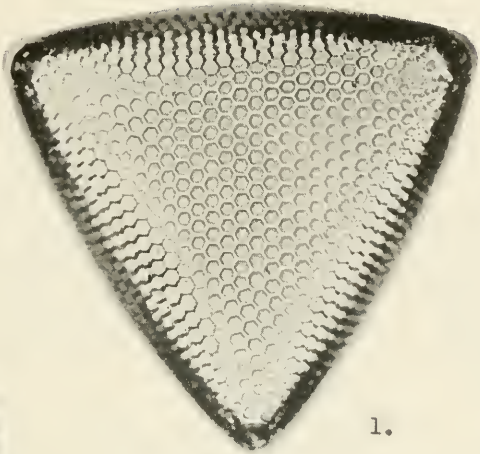
4.



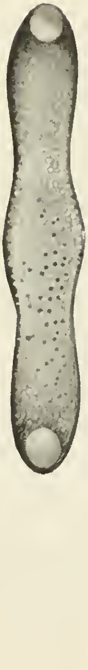
3.

DIATOMS OF THE PHILIPPINE ISLANDS

FOR EXPLANATION OF PLATE SEE PAGE 177

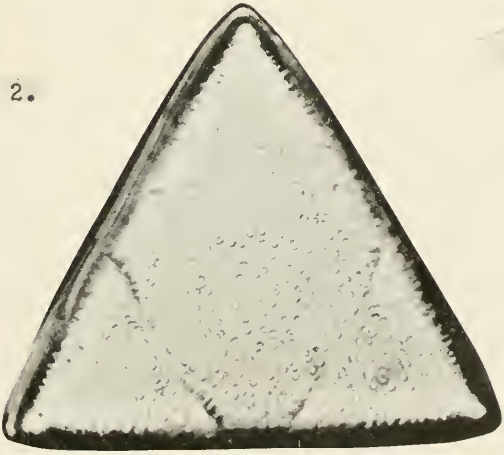


1.



2.

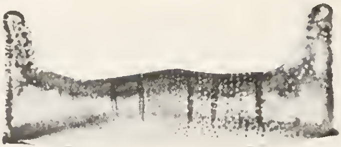
3.



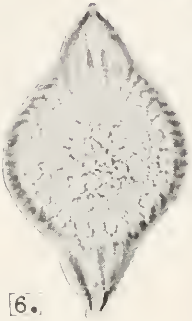
4.

Diatoms of the Philippine Islands

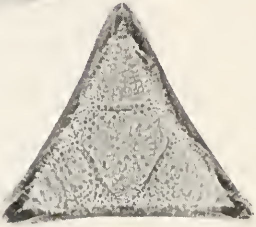
For explanation of plate see page 177



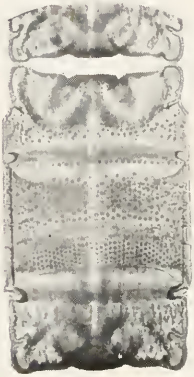
1.



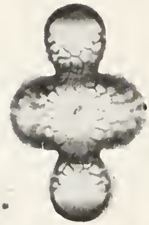
6.



3.

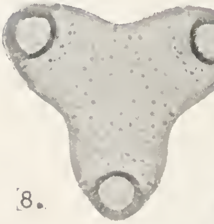


2.

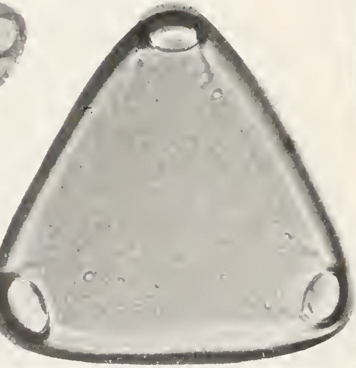


4.

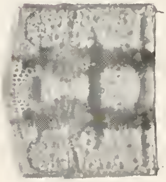
5.



8.



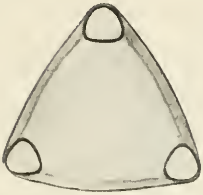
7.



9.

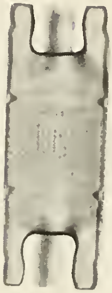
DIATOMS OF THE PHILIPPINE ISLANDS

FOR EXPLANATION OF PLATE SEE PAGE 177

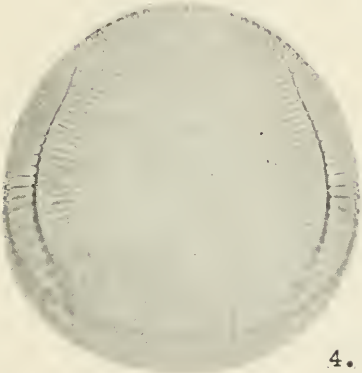


1.

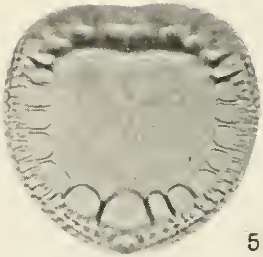
3.



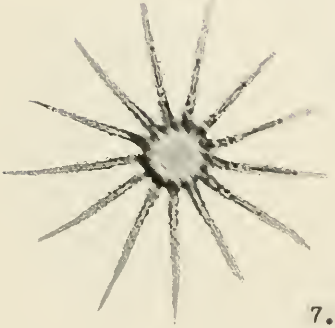
2.



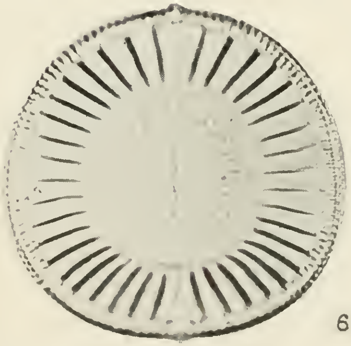
4.



5.



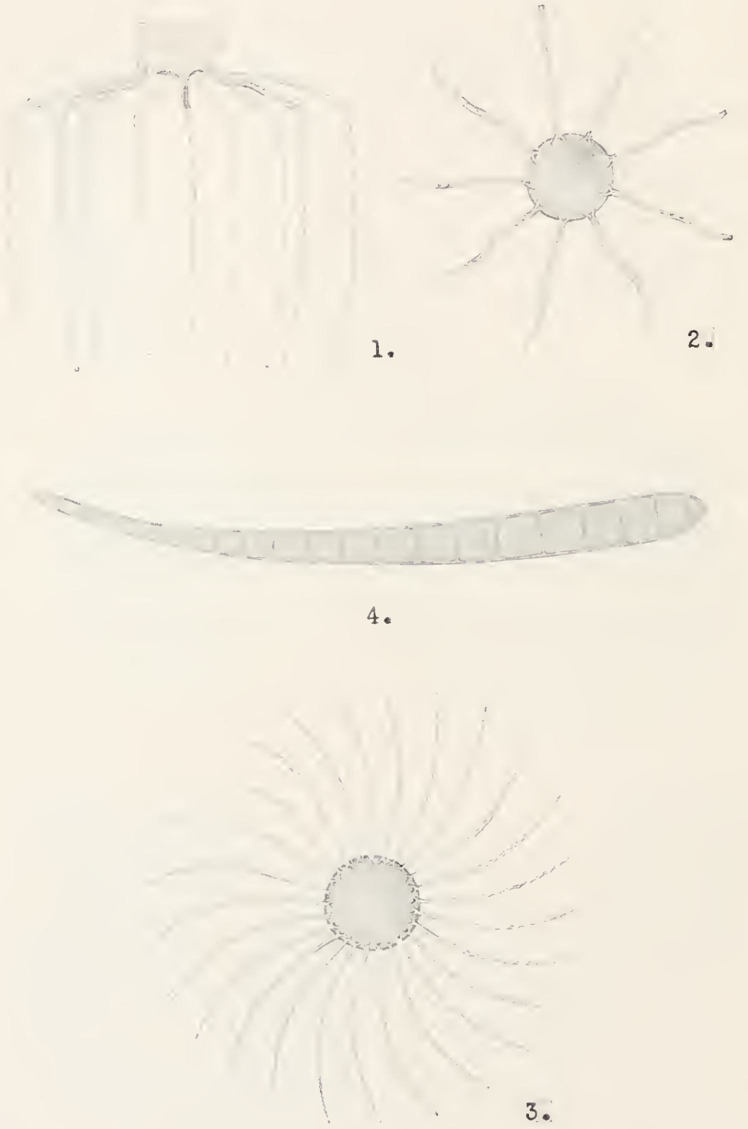
7.



6.

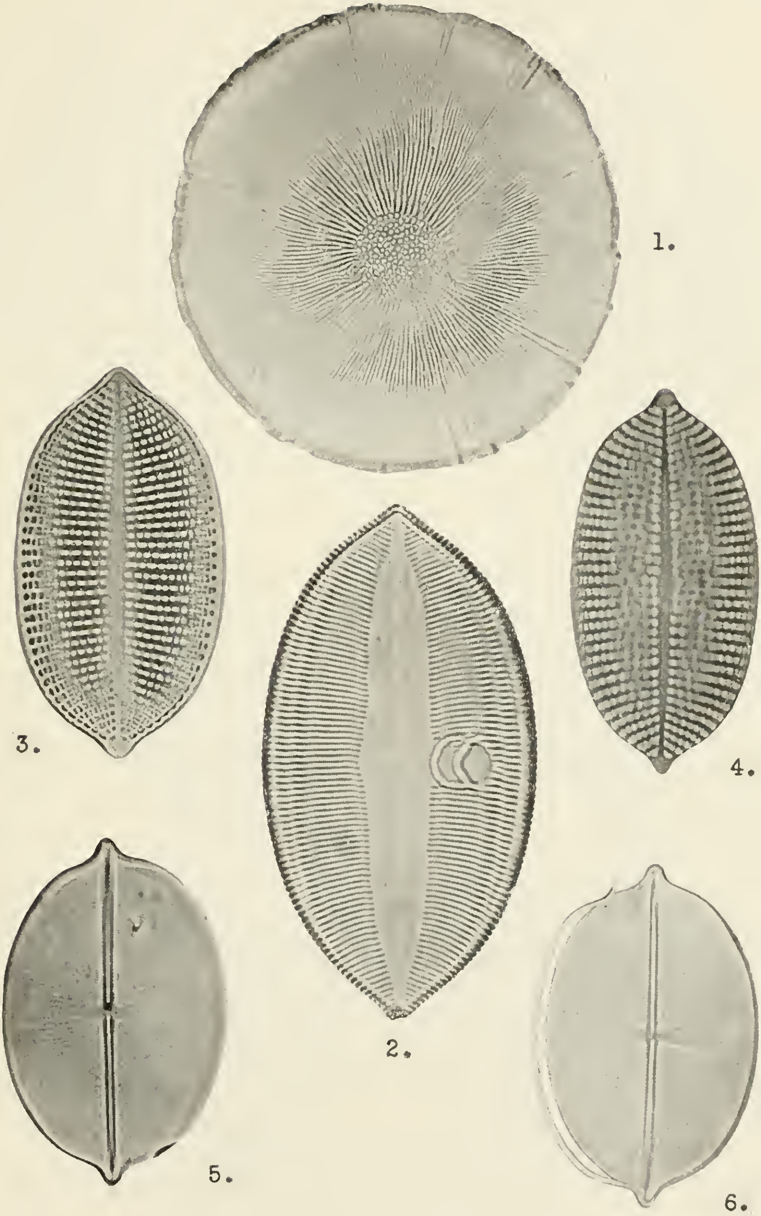
DIATOMS OF THE PHILIPPINE ISLANDS

FOR EXPLANATION OF PLATE SEE PAGE 177



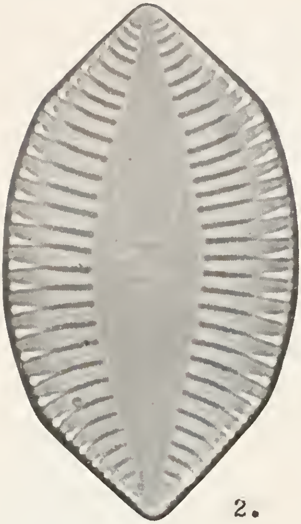
Diatoms of the Philippine Islands

For explanation of plate see page 177

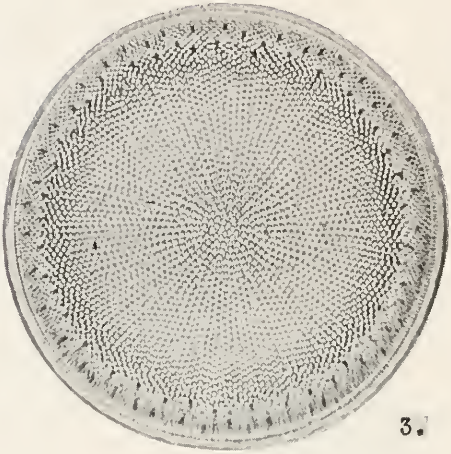


DIATOMS OF THE PHILIPPINE ISLANDS

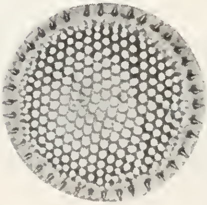
FOR EXPLANATION OF PLATE SEE PAGE 178



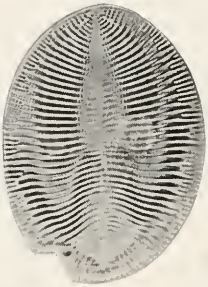
2.



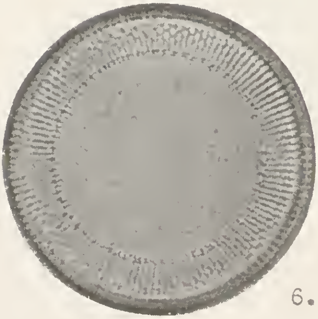
3.



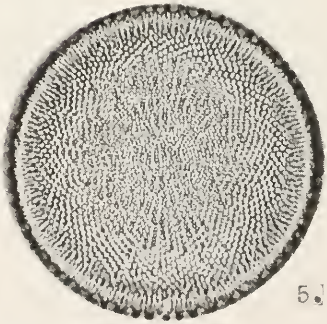
4.



1.



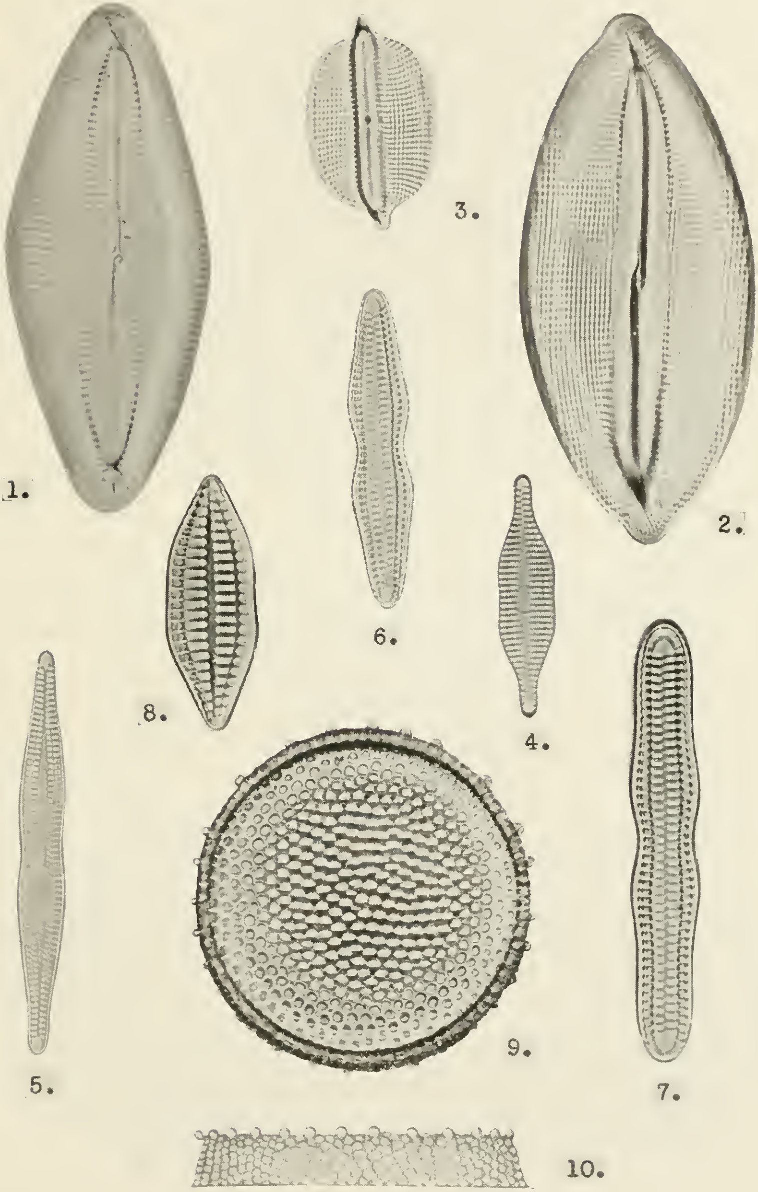
6.



5.

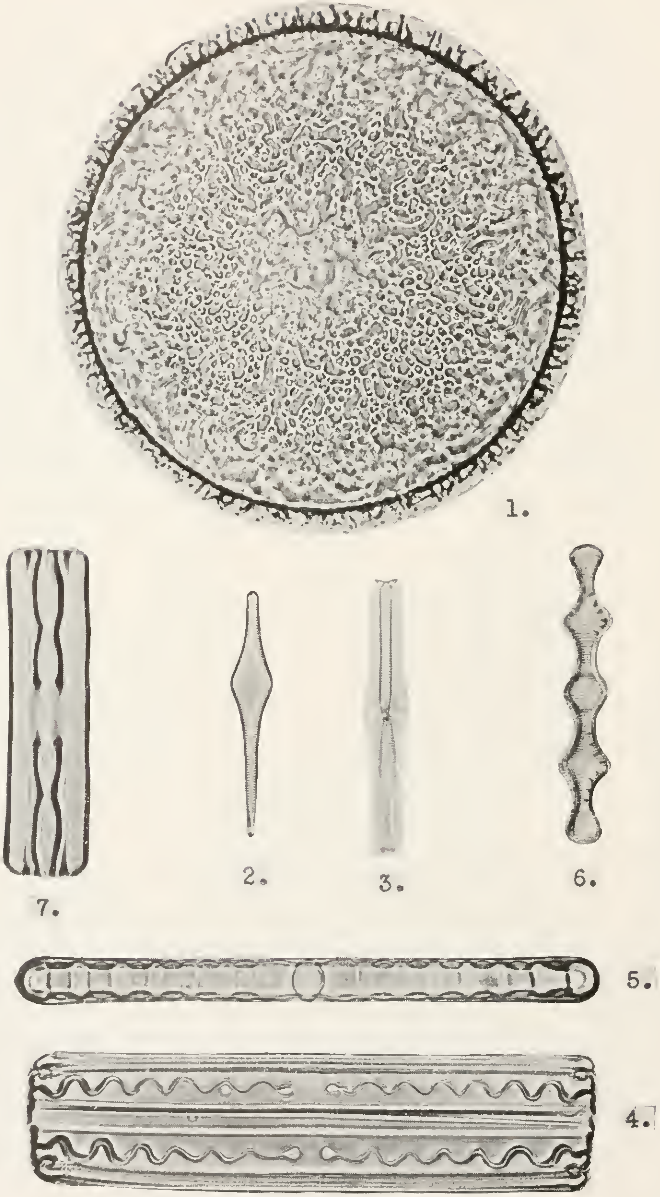
DIATOMS OF THE PHILIPPINE ISLANDS

FOR EXPLANATION OF PLATE SEE PAGE 178



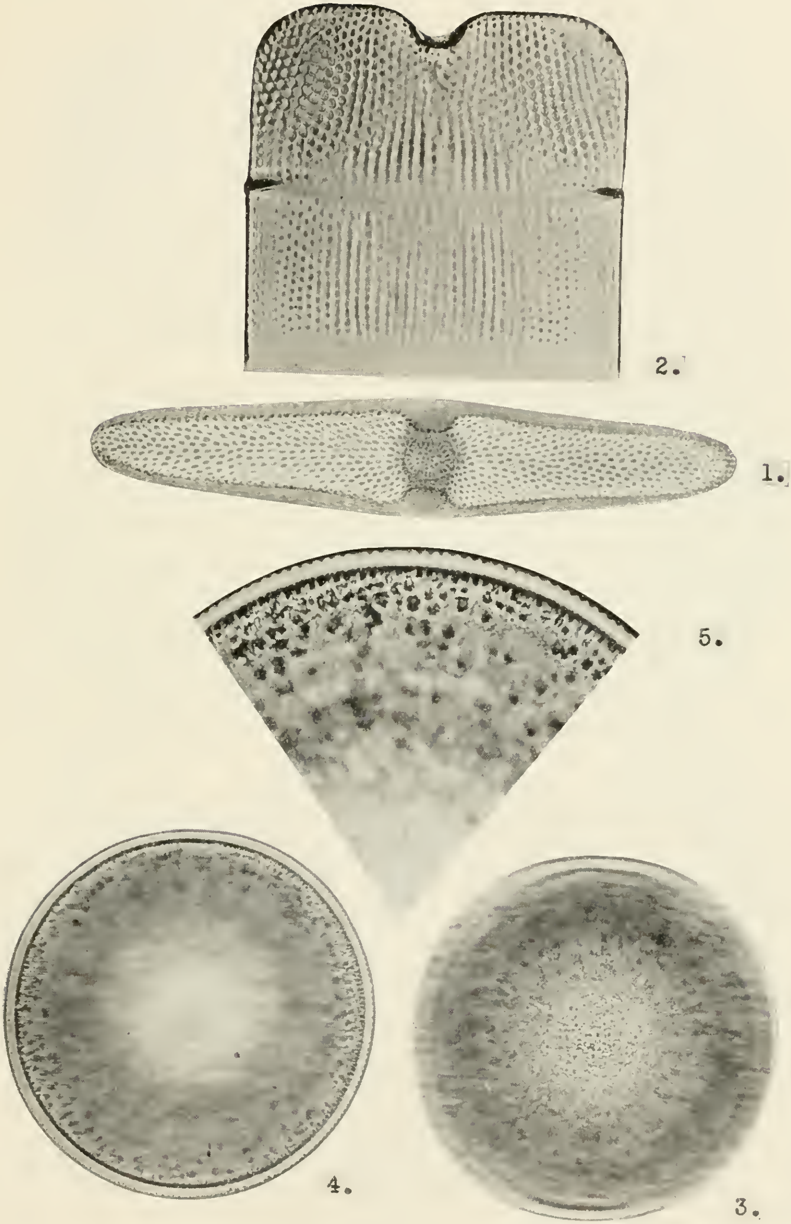
Diatoms of the Philippine Islands

For explanation of plate see page 178



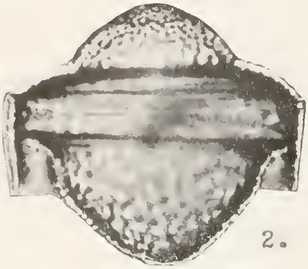
Diatoms of the Philippine Islands

For explanation of plate see page 178

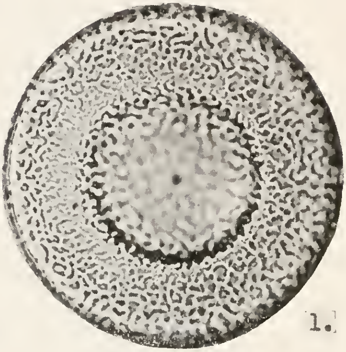


DIATOMS OF THE PHILIPPINE ISLANDS

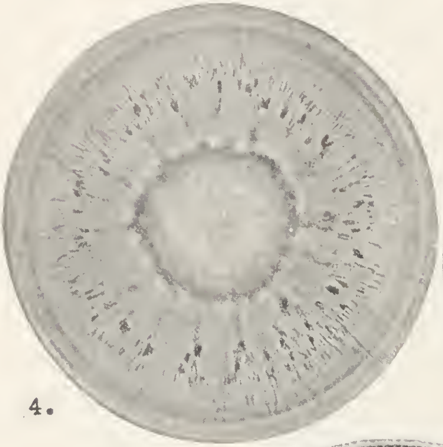
FOR EXPLANATION OF PLATE SEE PAGE 178



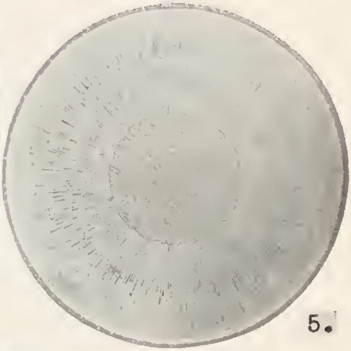
2.



1.

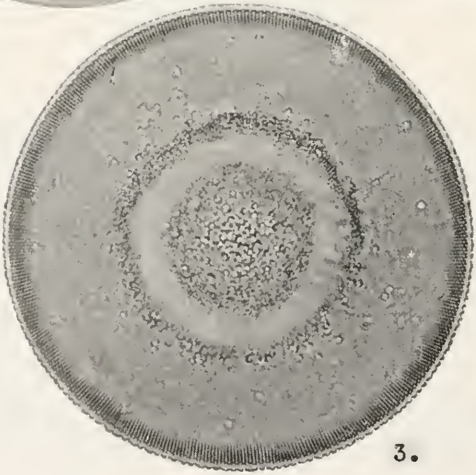


4.



5.

7.

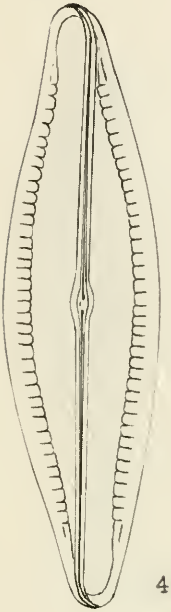


3.

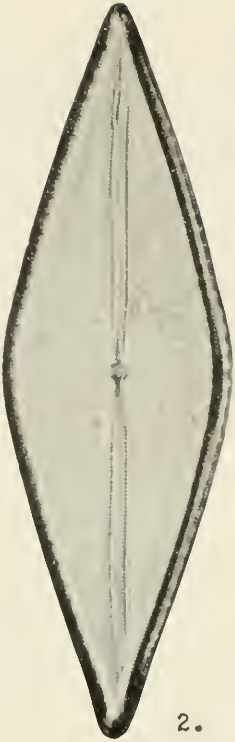
6.

Diatoms of the Philippine Islands

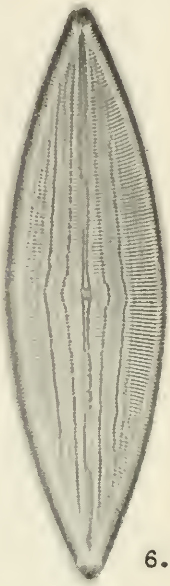
For explanation of plate see page 178



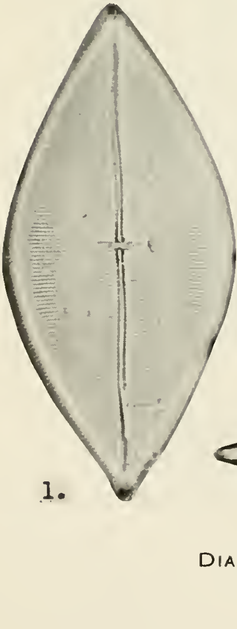
4.



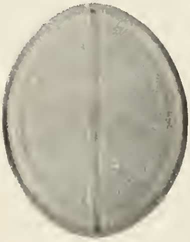
2.



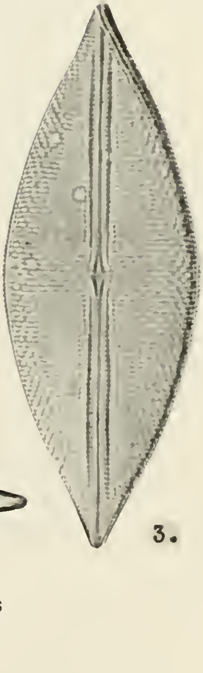
6.



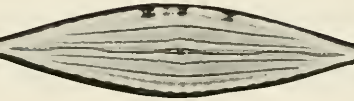
1.



5.



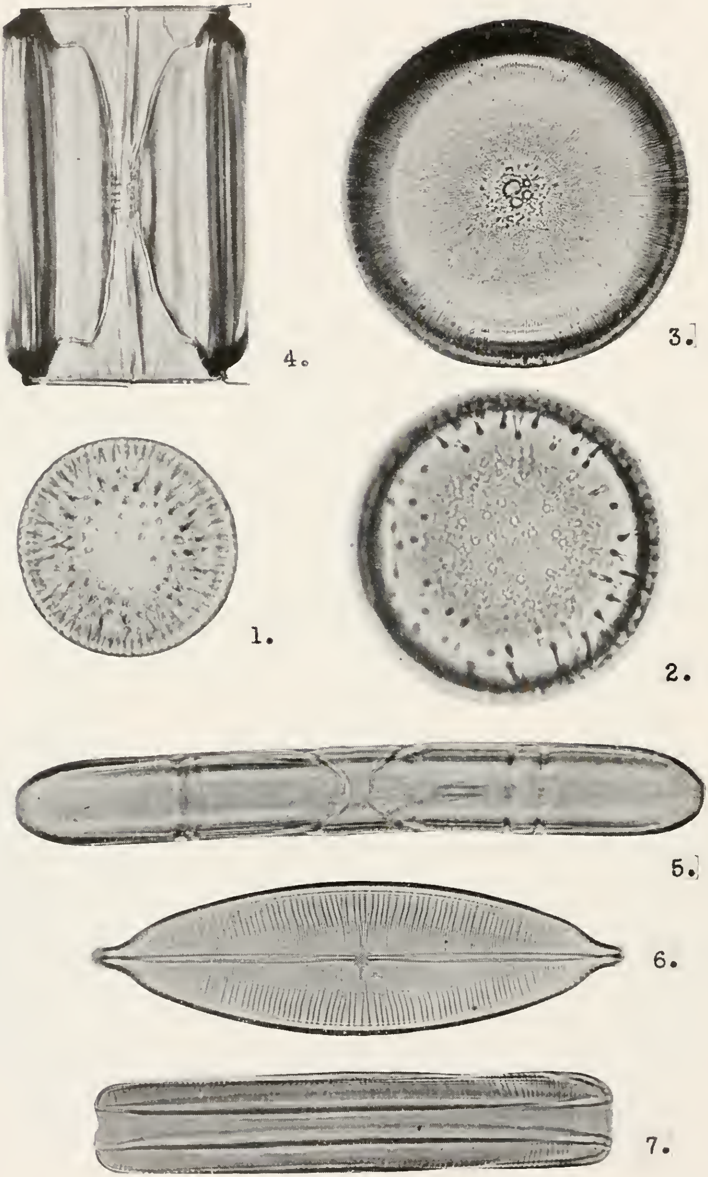
3.



7.

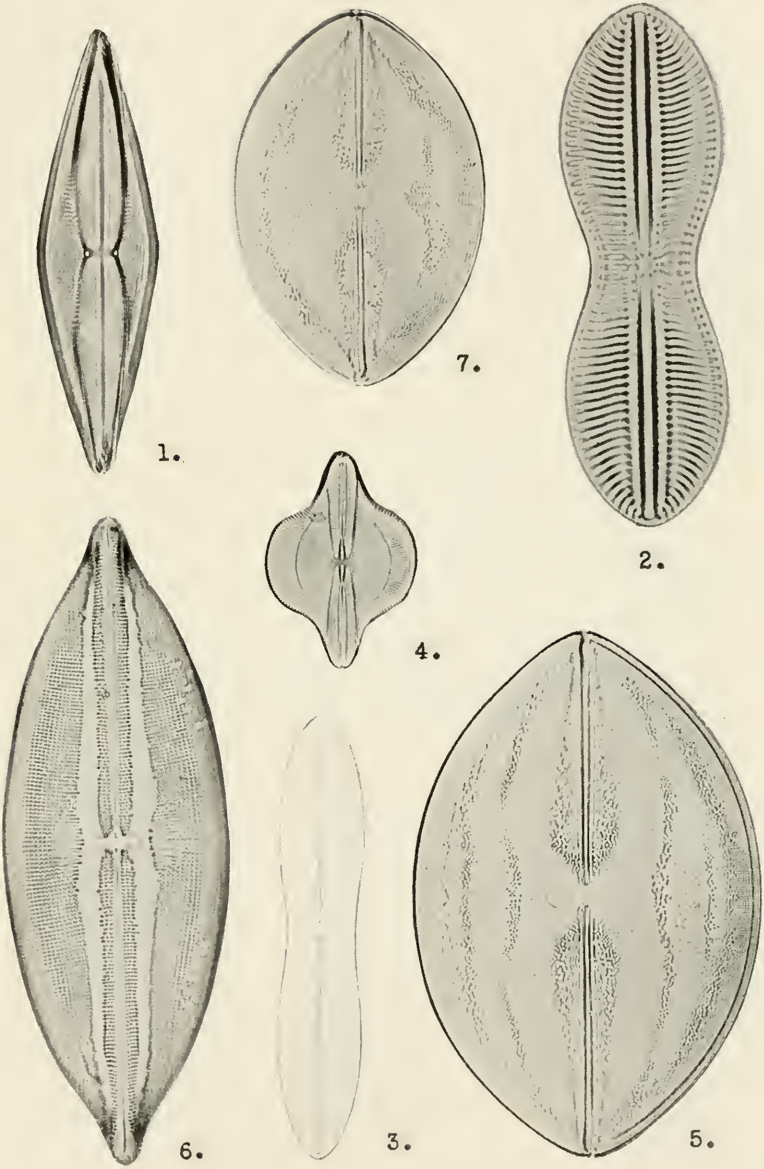
DIATOMS OF THE PHILIPPINE ISLANDS

FOR EXPLANATION OF PLATE SEE PAGE 179



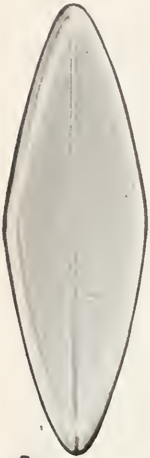
DIATOMS OF THE PHILIPPINE ISLANDS

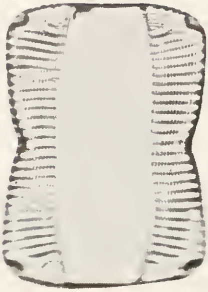
FOR EXPLANATION OF PLATE SEE PAGE 179

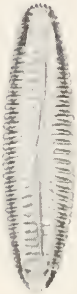


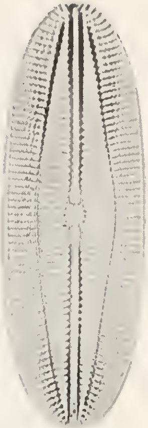
Diatoms of the Philippine Islands

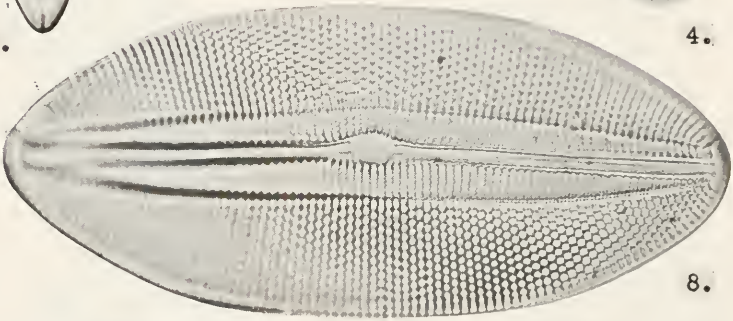
For explanation of plate see page 179

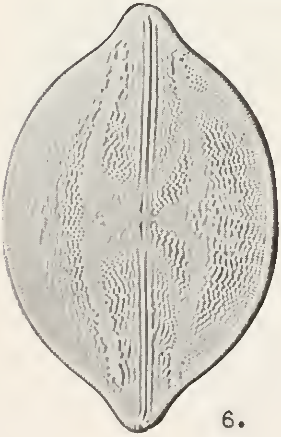

3.

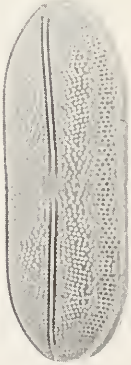

2.

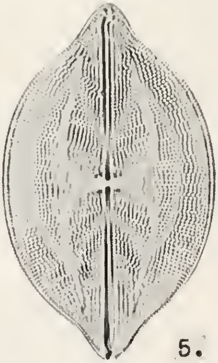

1.


4.


8.

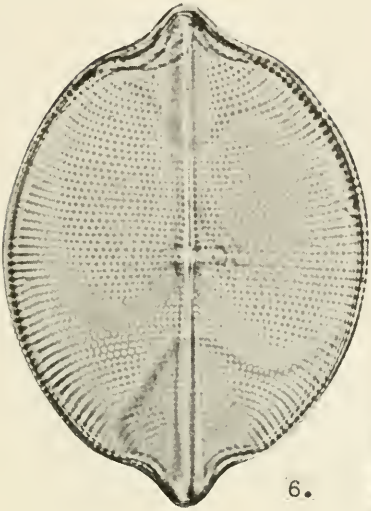

6.


7.

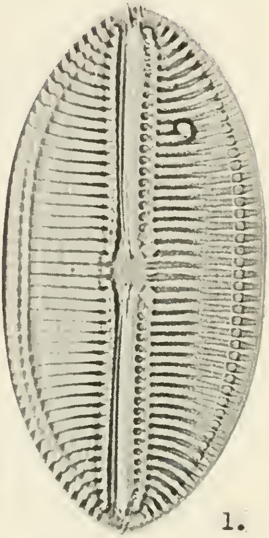

5.

Diatoms of the Philippine Islands

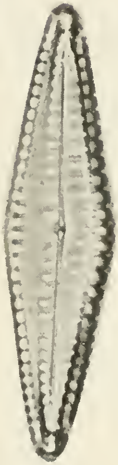
For explanation of plate see page 179



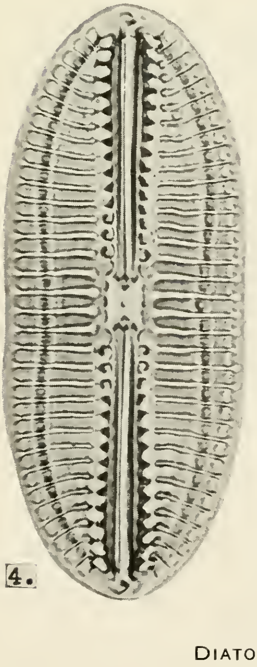
6.



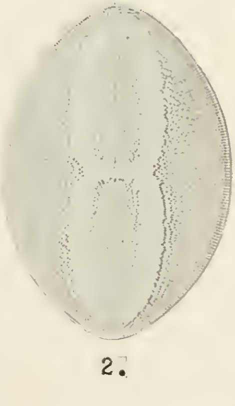
1.



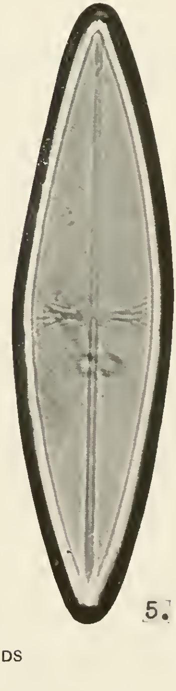
3.



4.



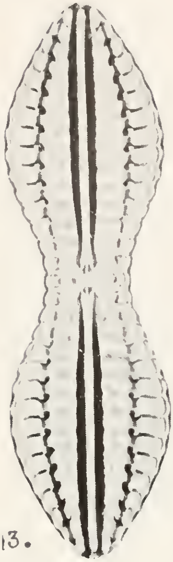
2.



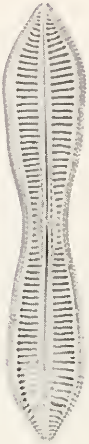
5.

Diatoms of the Philippine Islands

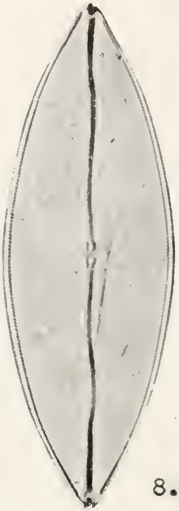
For explanation of plate see page 179



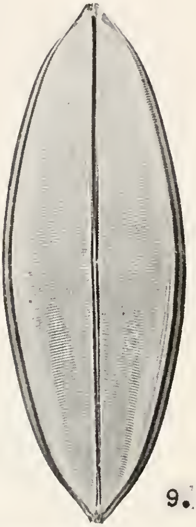
3.



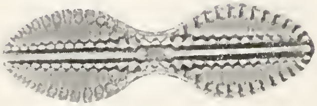
6.



8.

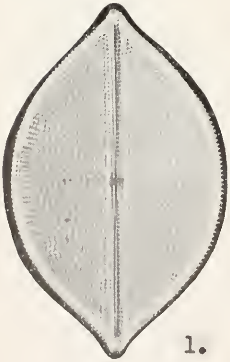


9.

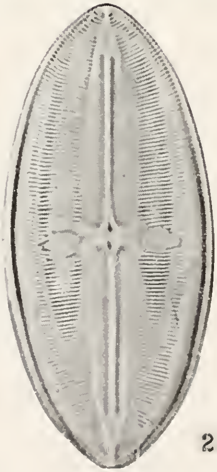


4.

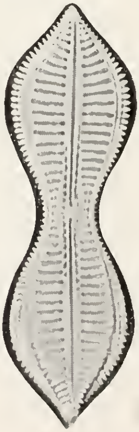
7.



1.



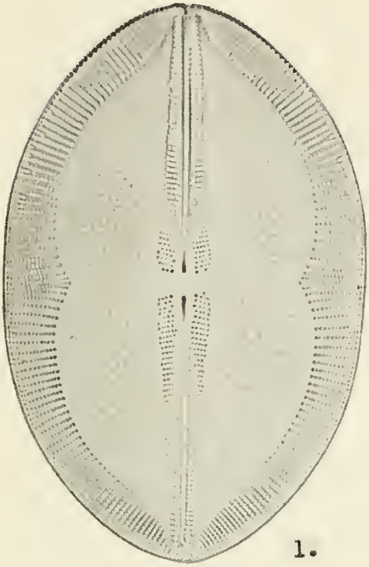
2.



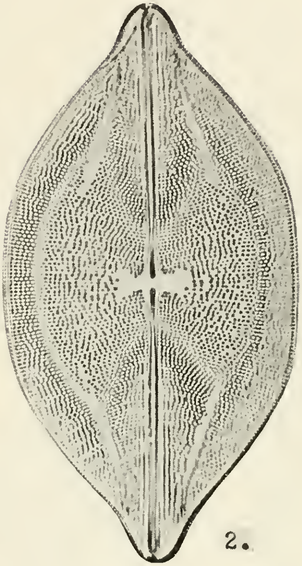
5.

DIATOMS OF THE PHILIPPINE ISLANDS

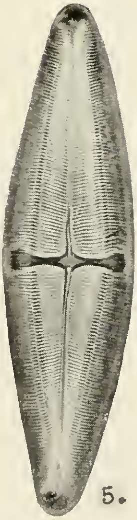
FOR EXPLANATION OF PLATE SEE PAGE 180



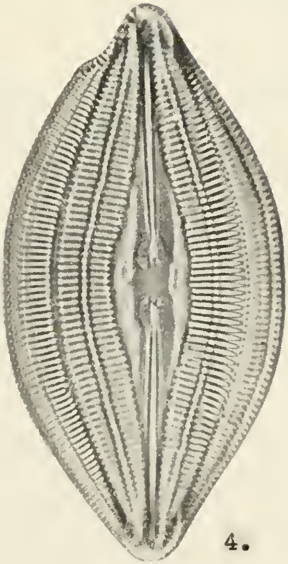
1.



2.



5.

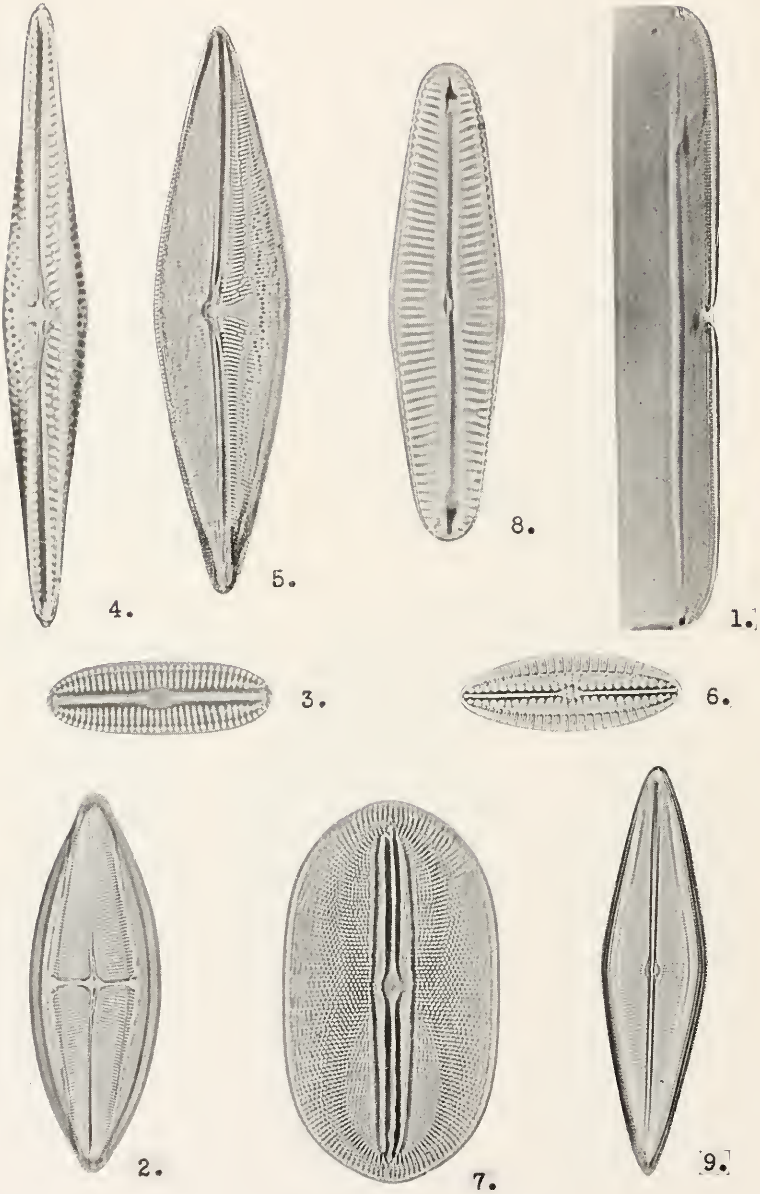


4.

3.

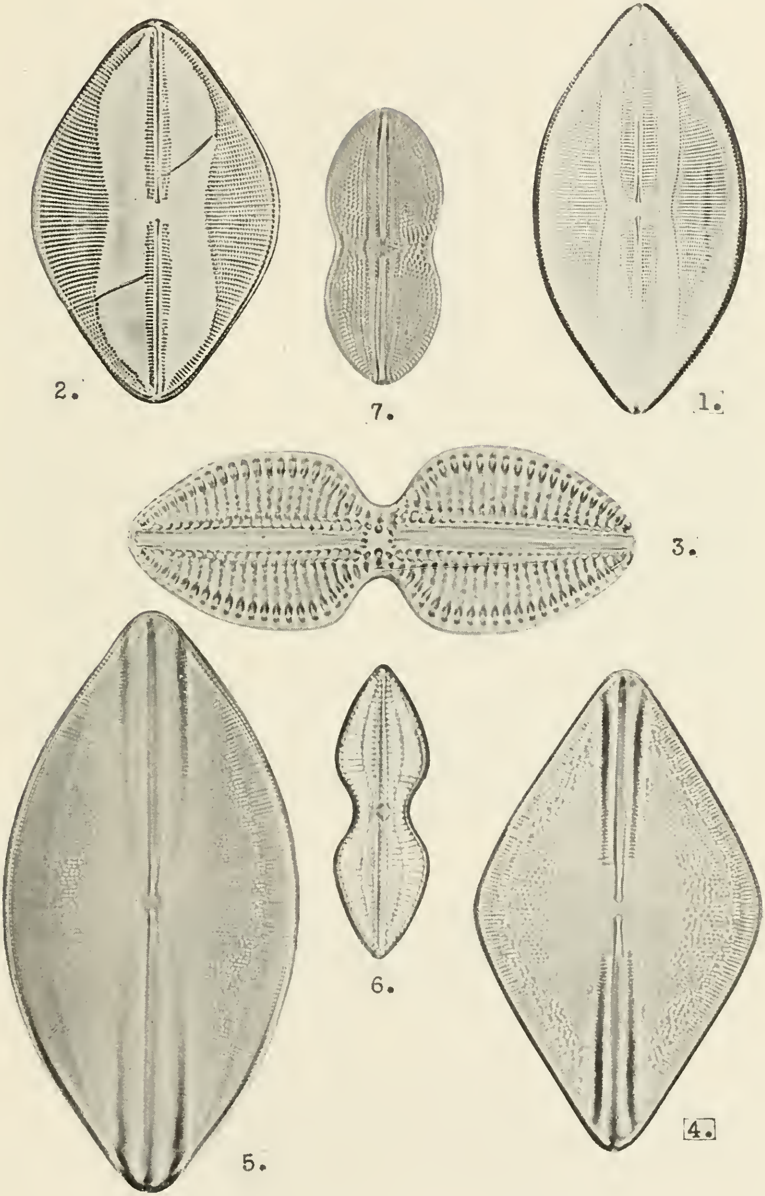
DIATOMS OF THE PHILIPPINE ISLANDS

FOR EXPLANATION OF PLATE SEE PAGE 180



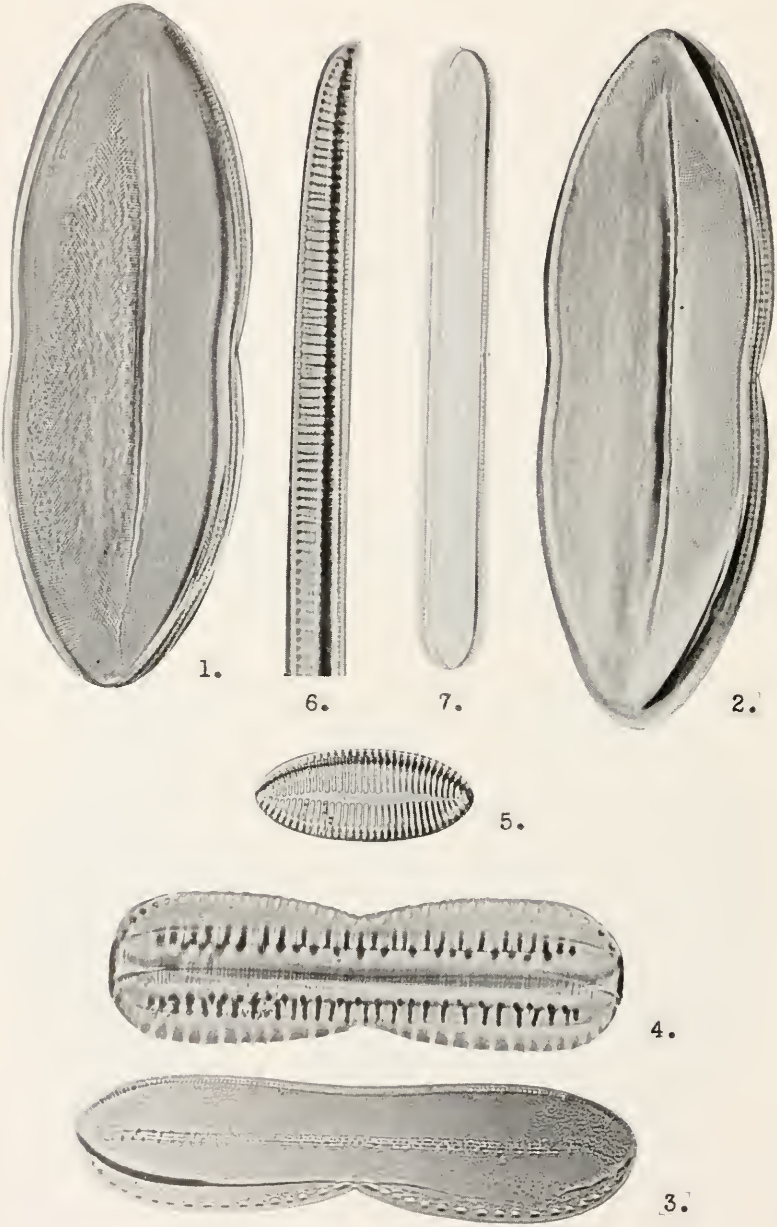
Diatoms of the Philippine Islands

For explanation of plate see page 180



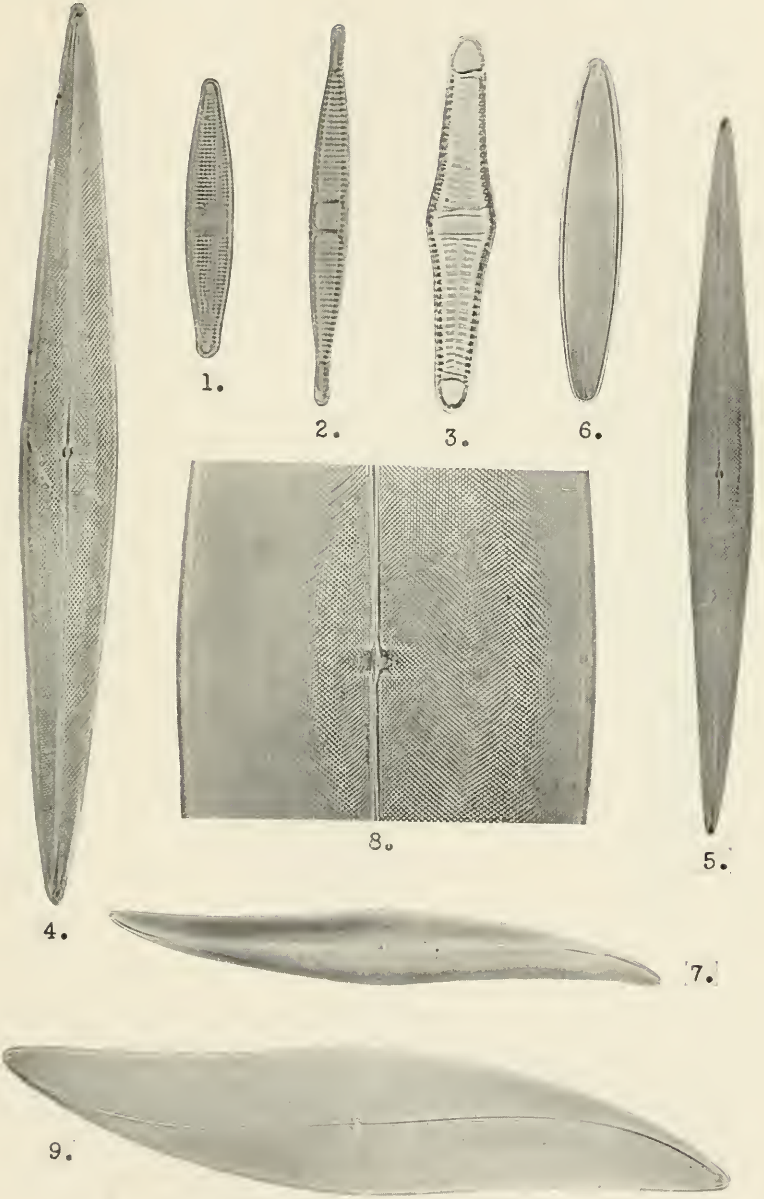
Diatoms of the Philippine Islands

For explanation of plate see page 18



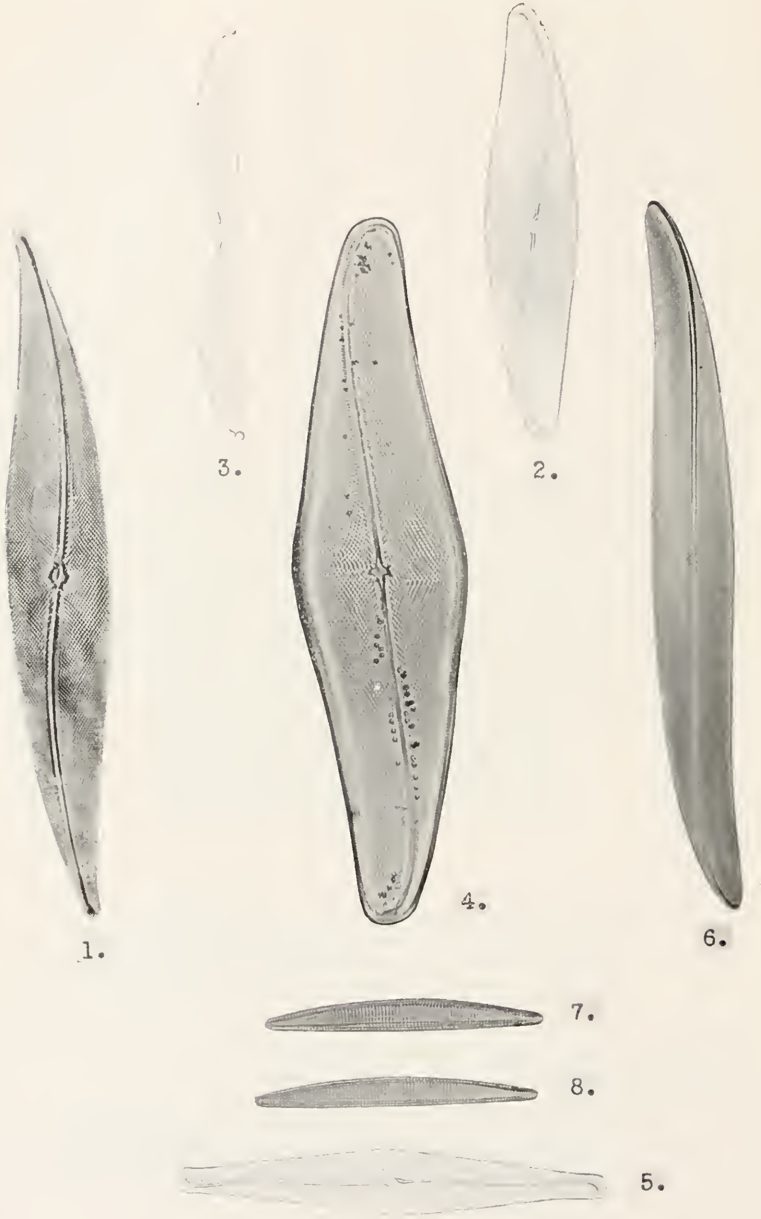
DIATOMS OF THE PHILIPPINE ISLANDS

FOR EXPLANATION OF PLATE SEE PAGE 180



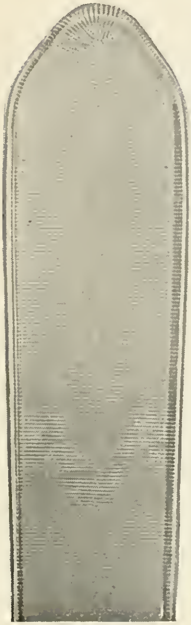
DIATOMS OF THE PHILIPPINE ISLANDS

FOR EXPLANATION OF PLATE SEE PAGE 181

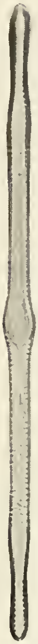


DIATOMS OF THE PHILIPPINE ISLANDS

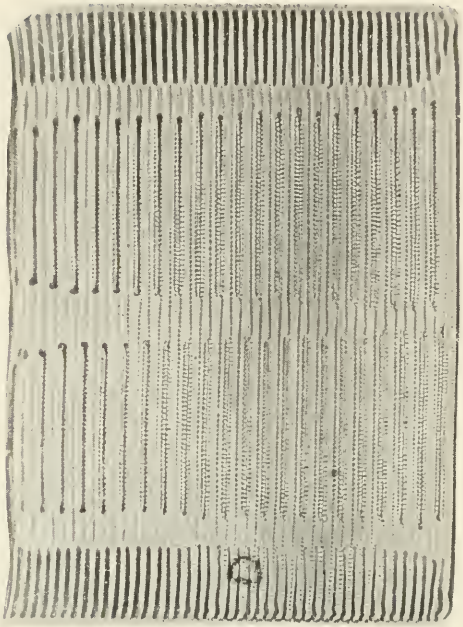
FOR EXPLANATION OF PLATE SEE PAGE 181



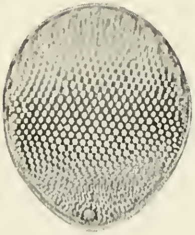
4.



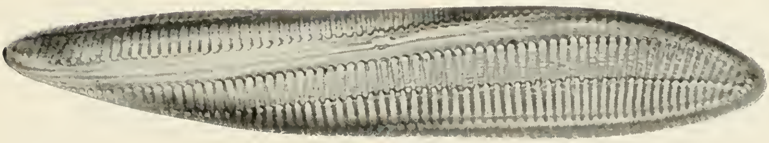
2.



1.



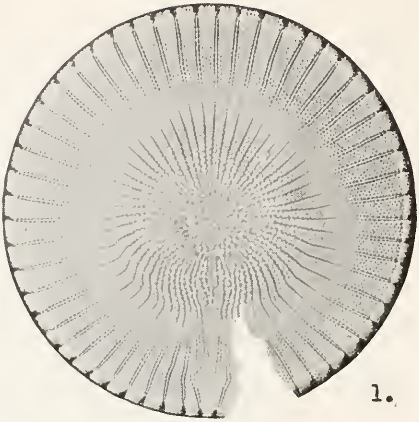
3.



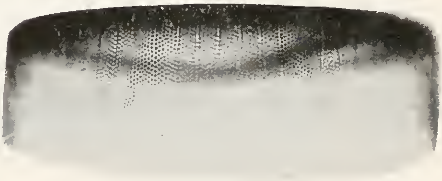
5.

Diatoms of the Philippine Islands

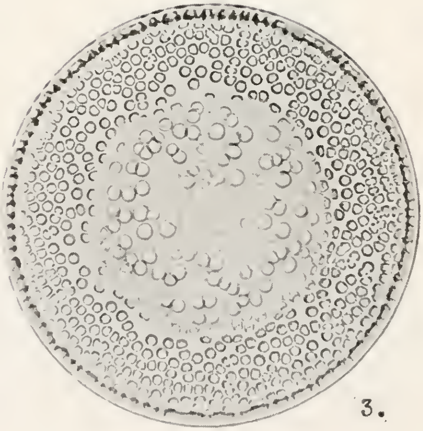
For explanation of plate see page 181



1.



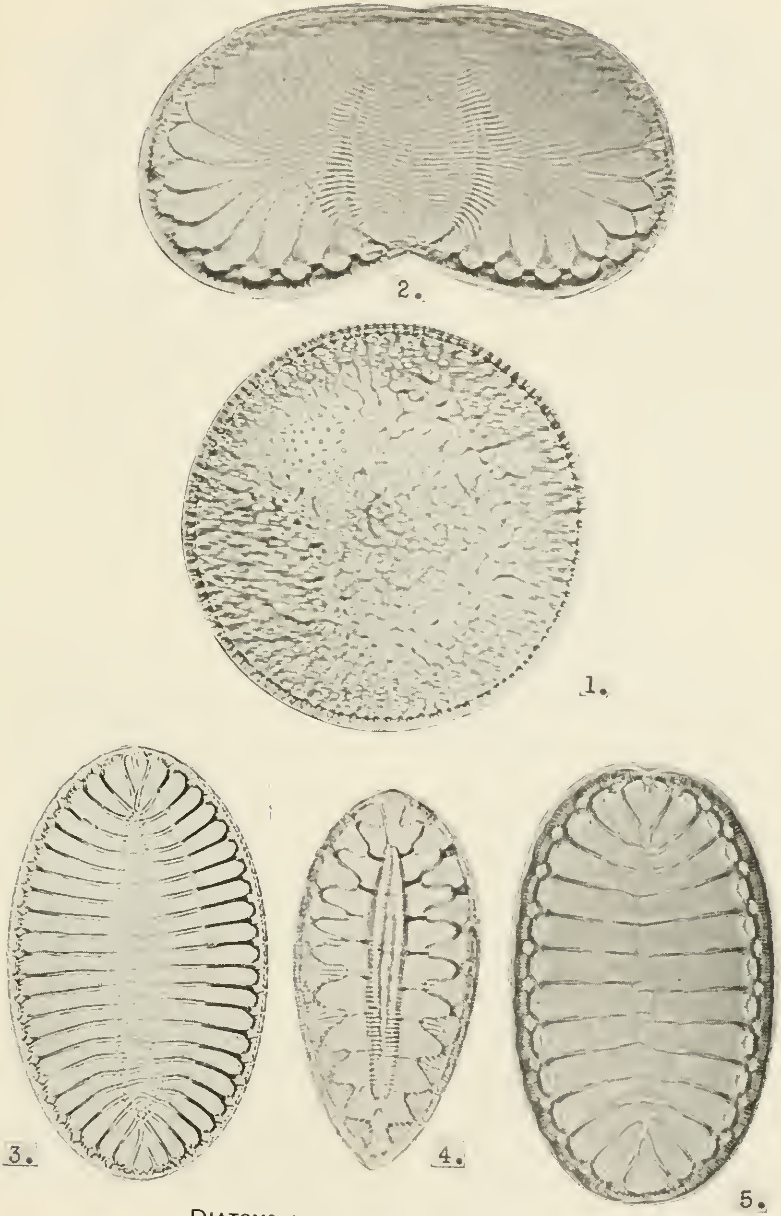
2.



3.

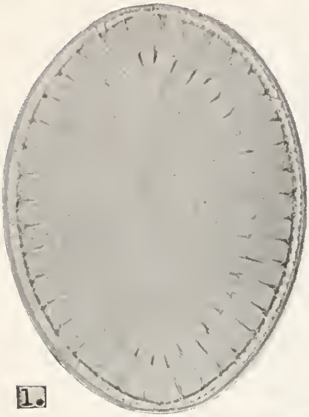
Diatoms of the Philippine Islands

For explanation of plate see page 181

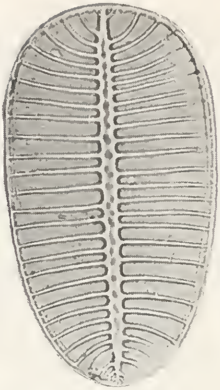


DIATOMS OF THE PHILIPPINE ISLANDS

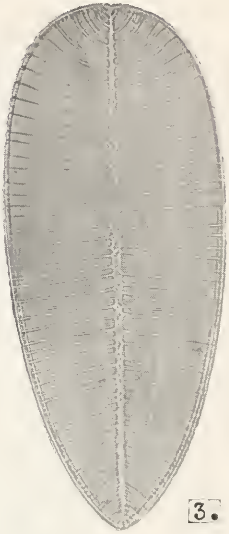
FOR EXPLANATION OF PLATE SEE PAGE 181



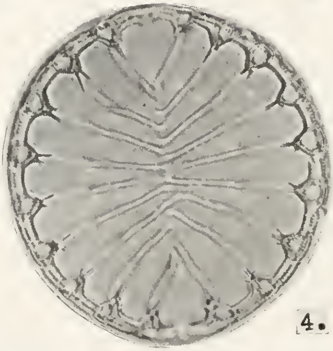
1.



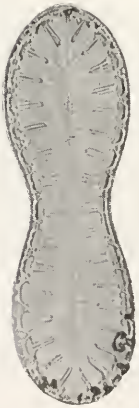
2.



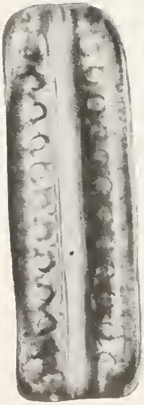
3.



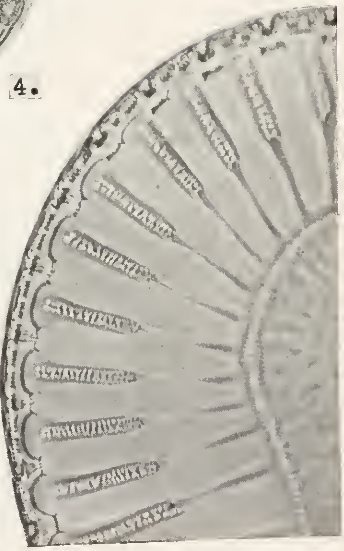
4.



5.



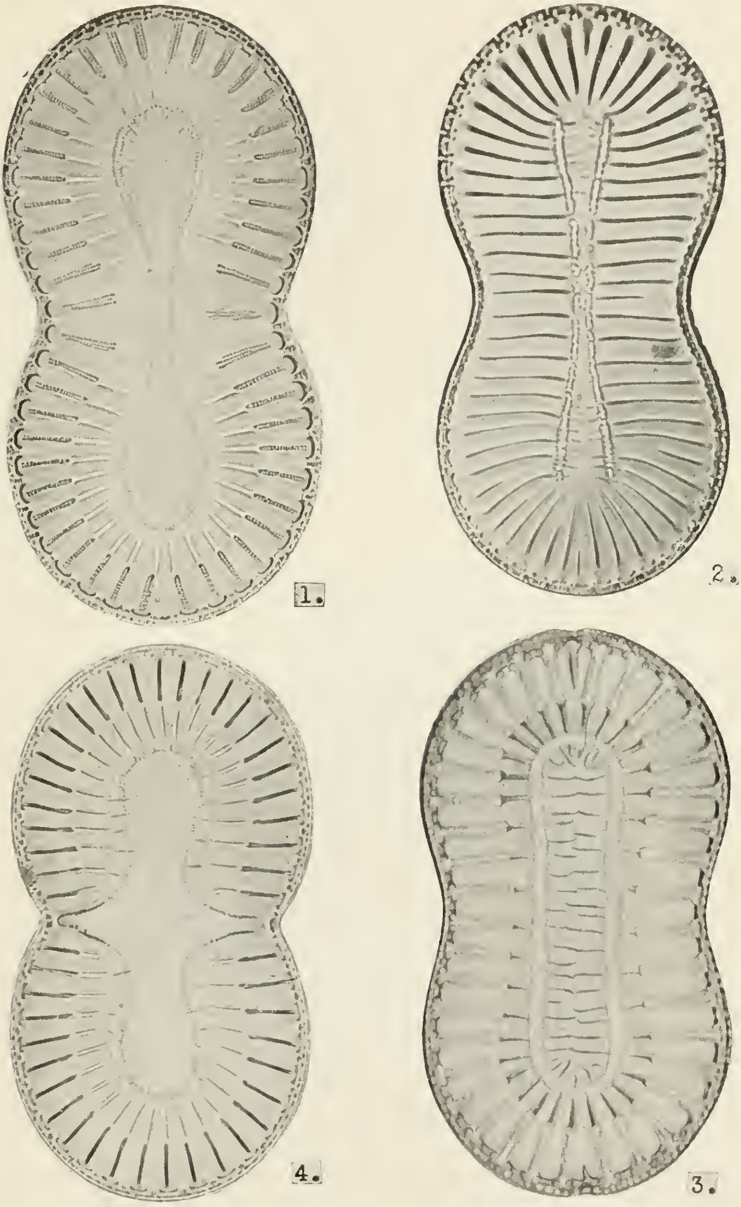
6.



7.

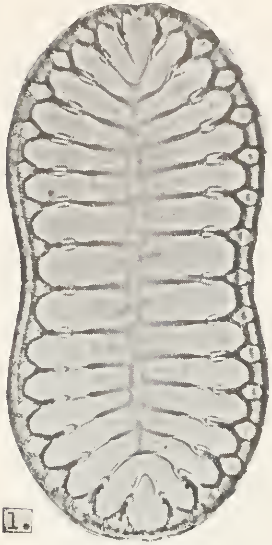
Diatoms of the Philippine Islands

For explanation of plate see page 181

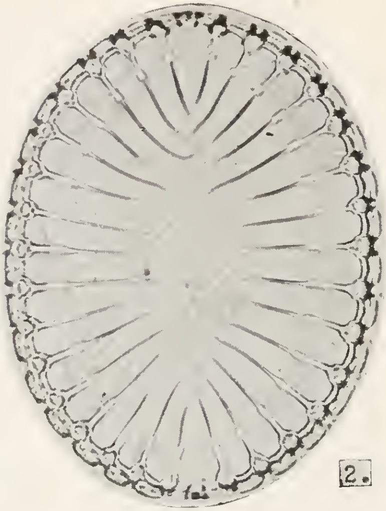


Diatoms of the Philippine Islands

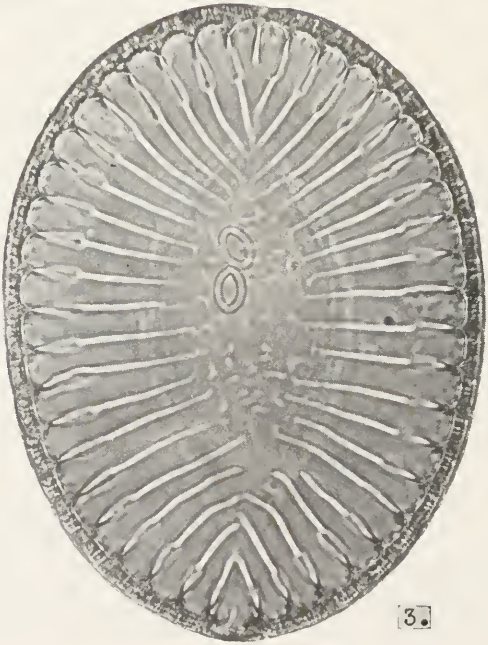
For explanation of plate see page 182



1.



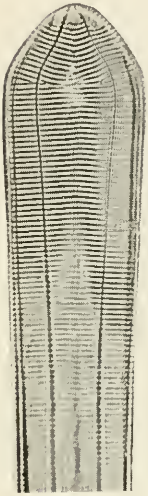
2.



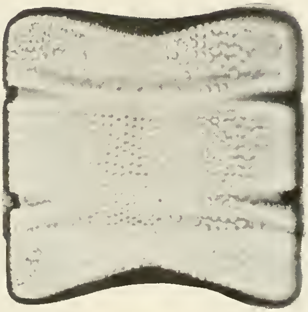
3.

DIATOMS OF THE PHILIPPINE ISLANDS

FOR EXPLANATION OF PLATE SEE PAGE 182

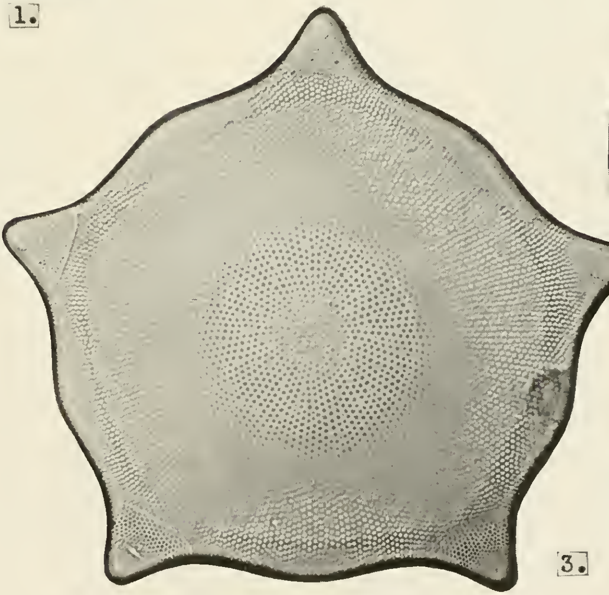


1.



4.

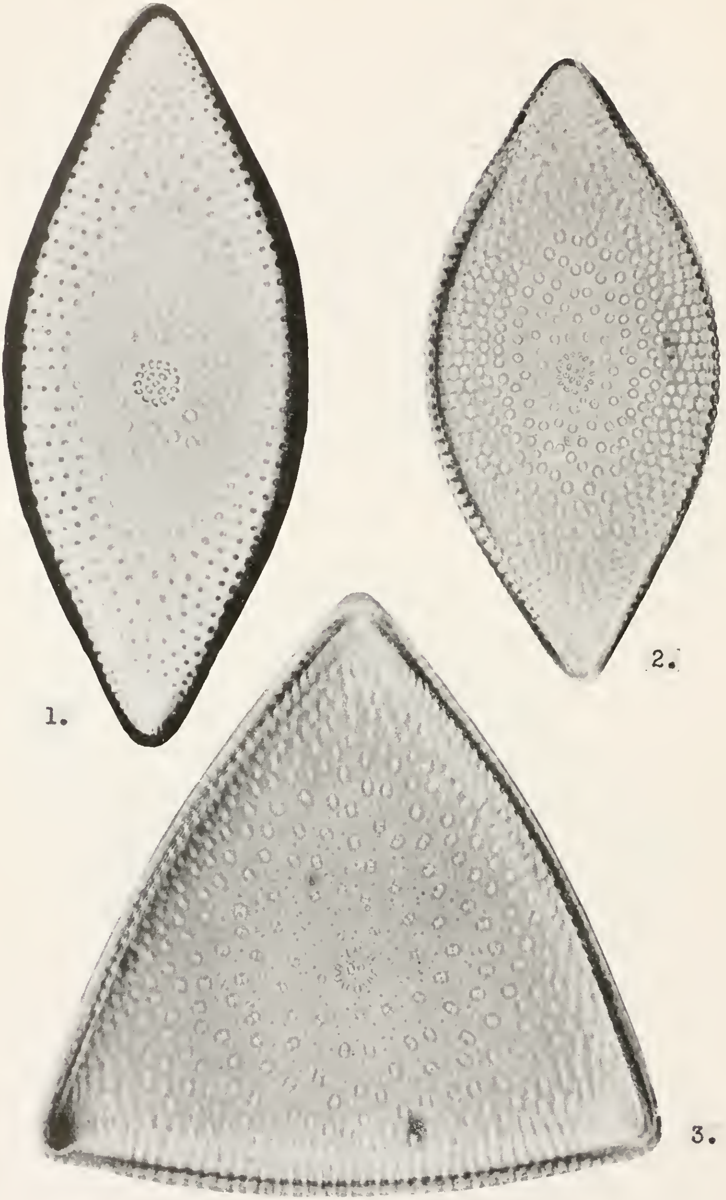
2.



3.

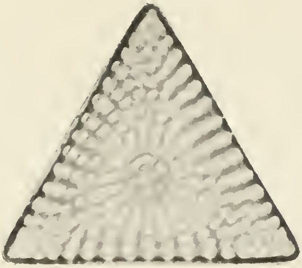
DIATOMS OF THE PHILIPPINE ISLANDS

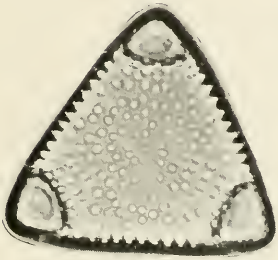
FOR EXPLANATION OF PLATE SEE PAGE 182

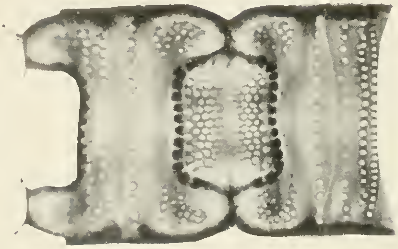


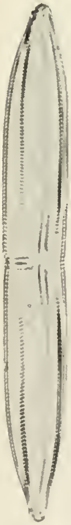
DIATOMS OF THE PHILIPPINE ISLANDS

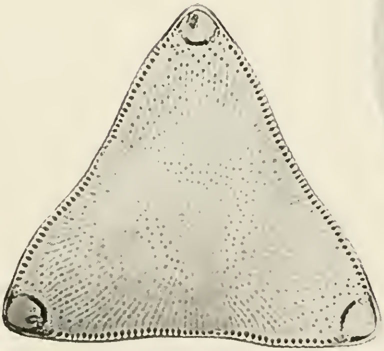
FOR EXPLANATION OF PLATE SEE PAGE 182


6.


2.


3.


5.


1.

4.

DIATOMS OF THE PHILIPPINE ISLANDS

FOR EXPLANATION OF PLATE SEE PAGE 182

ADDITIONS TO THE POLYCHAETOUS ANNELIDS COLLECTED BY THE UNITED STATES FISHERIES STEAMER "ALBATROSS," 1907-1910, INCLUDING ONE NEW GENUS AND THREE NEW SPECIES

By A. L. TREADWELL

Of the Department of Zoology, Vassar College
Poughkeepsie, New York

INTRODUCTION

Of the polychaetous annelids collected in the region of the Philippine Islands by the United States Fisheries steamer *Albatross* in 1907 to 1909 the greater part were described by Treadwell (Bull. U. S. Nat. Mus. vol. 1, pt. 8, 1920) and by Hoagland (Idem, vol. 1, pt. 9). Other material from this same collection was later sent me by Dr. W. L. Schmitt, of the United States National Museum. In the following paper I have recorded some old species not represented in the original lot, as well as descriptions of some new species.

DESCRIPTIONS OF SPECIES

Family POLYNOIDAE

Genus IPHIONE Savigny

IPHIONE MURICATA Savigny

Iphione muricata Savigny, Systéme des Annélides, 1820, p. 21, pl. 2, fig. 1.—Grube, Annulata Semperiana, Mem. Akad. Imp. Sci. St. Petersbourg, vol. 25, no. 8, 1878, pp. 21, 22.

One specimen collected at Naw Waw, Formosa.

Family APHRODITIDAE

Genus LAETMONICE Kinberg

LAETMONICE NITIDA, new species

Figures 1 to 5

Two specimens collected at Station 5139[1] are evidently closely related to *L. producta* of Grube,[2] McIntosh[3] described a number of specimens in the *Challenger* collection as varieties of this species, and it may be that these from the Philippines should be so identified. The main differences between these and those of McIntosh lie in the character of the setae and in the fact that in his varieties the ones which most nearly approach these in other respects have considerable covering of felt which is absent in the Philippine individuals.

---

[1] Vicinity of Jolo, 6° 06′ N., 121° 02′ 30″ E., Feb. 14, 1908, 20 fathoms.

[2] Monats. K. Akad, zu Berlin, 1877, p. 512.

[3] McIntosh, W. C.: Report on the Annelida Polychaeta collected by H. M. S. *Challenger* during the years 1873, 1876. Report on the Scientific Results of the Voyage of H. M. S. *Challenger*, vol. 12, 1885, pp. 39-50.

The longer specimen has a body length of 22 mm. and a width of 8 mm., the smaller is 15 mm. long and 6 mm. wide. There are 35 somites, and 15 elytra is evidently the normal number, though in neither case were all of these present.

The prostomium (fig. 1), in the smaller specimen is about 0.75 mm. wide, globular in form with the ceratophore of the median tentacle and the two ocular peduncles covering the anterior quarter of its circular outline. Toward the posterior end of the dorsal surface is a decided elevation which posteriorly is continued laterally on either side by a ridge which merges into the base of the prostomium. Its posterior margin is overlapped by a fold from the first somite. The eyes are carried on short peduncles and are rather small, only the dorsal ones being visible from the dorsal surface. The ventral eyes are about the same size as the dorsal and lie a little nearer the outer margin of the peduncle than do the dorsal.

The ceratophore of the median tentacle is nearly one half as broad as the prostomium, its base more or less corrugated and tinged with brown. One specimen had lost the median tentacle and it was broken from the other before an accurate description could be recorded so that the most I can say is that it was slender and longer than the prostomium. The palps are from eight to ten times as long as the prostomium, are smooth as seen under a dissecting lens, but under higher magnification show large numbers of short "cilia" over their entire surfaces. The dorsal cirri are slender and taper gradually toward the end but have a small bulbous swelling toward the apex. They are fully equal in length to the transverse diameter of the body. There is no well-marked ventral groove but the entire ventral surface is covered with minute rounded papillae giving it a rugose appearance.

The body tapers very decidedly at both anterior and posterior ends and the parapodia in these regions are correspondingly small, those at the anterior end extending lateral to the mouth in the customary fashion. Parapodia from the middle of the body have large truncated notopodial lobes and slender cylindrical, neuropodial ones. Arising from the dorsal surface of the lobe and extending posterolaterally over the elytron or the cirrus as the case may be, is a fan-shaped row of slender setae, dark yellowish-brown in color for rather less than half their length, the remainder being light straw. They taper very decidedly to the apex which is curved (fig. 2.). Ventral to these arises another tuft of chestnut-brown setae of varying lengths but the longest are fully equal to the transverse body diameter. In both specimens they are much disarranged and their normal position is not easy to determine. They have smooth margins and end in a lance-shaped apex with a subapical row of barbs on either side. The pair of these barbs nearest the end are opposite one another while farther down they assume an alternating arrangement (fig. 3.). Rounded papillae like those on the ventral body surface occur sparingly on the notopodial surfaces.

The neuropodium is slender, cylindrical, and covered with globular papillae. About midway of its length is a slender ventral cirrus which does not reach the apex of the neuropodium. The most prominent of the neuropodial setae are, relatively to the size of the neuropodium itself, very heavy, and brown in color becoming lighter in tint toward the outer ends. At the apex they bifurcate asymmetrically (fig. 4.), the larger branch terminating in a gently curved tip while there is a series of lateral teeth between the two branches. Probably through accidental breaking the number of these latter teeth varies, but a fairly typical one is shown in the figure. In most of the parapodia examined, these were the only neuropodial setae to be found but in one specimen one other kind is present. This has a central axis, narrowing to an acute point. Beginning at the point of narrowing and extending toward the apex, are two rows of stout teeth. In some positions of the seta these appear to be opposite one another but they really are both nearer one side of the axis. Figure 5 represents one row of teeth in full face and the other in profile. Material was not available on which to determine the distribution of these setae along the body and I am unable to say whether they are regularly present or absent from any portion. The setae above described are in general much like those figured by McIntosh[4] but I was unable to find any of the brushlike setae figured in plate 4*a*, figures 8 to 10, in plate 5*a*, figures 2, 4, 8, and 9.

The elytra are white and very delicate in texture and in both specimens are entirely free from foreign matter. The first ones are nearly circular in outline, are small but cover the prostomium. Later ones are more nearly oval. Under high power the surface shows numerous round spots with granular lines running more or less parallel to one another between and around the spots. The elytra completely cover the dorsum.

---

[4] McIntosh, W. C.: Report on the Annelida Polychaeta collected by H. M. S. *Challenger* during the years 1873, 1876. Report on the Scientific Results of the Voyage of H. M. S. *Challenger,* vol. 12, 1885, pls. 4*a* and 5*a*.

The peculiar marking on the surface of the elytra recalls the structure of the elytra of *L. pellucida* Moore, from Bering Sea.[5]

Type.—Cat. No. 19206, U.S.N.M.

Family ACOETIDAE

Genus EUPANTHALIS McIntosh

EUPANTHALIS EVANIDA, new species

Figures 6 to 12

Two specimens were collected at Station D 5526, between Siquijor and Bohol Islands, 9° 12′ 45″ N., 123° 45′ 30″ E., August 10, 1909, 805 fathoms, one the holotype, bears Cat. No. 19208 U. S. N. M. Neither is entire, each retaining only about the anterior 50 somites. Apparently through the action of the preserving fluids all color has been lost even in the eyes which are recognizable only because of their form.

The prostomium of the type has a width of 1 mm. Following somites successively increase up to the region of the eighth, which measures approximately 5 mm. There is posteriorly a gradual decrease in diameter so that somite 50 is hardly more than 2 mm. in width.

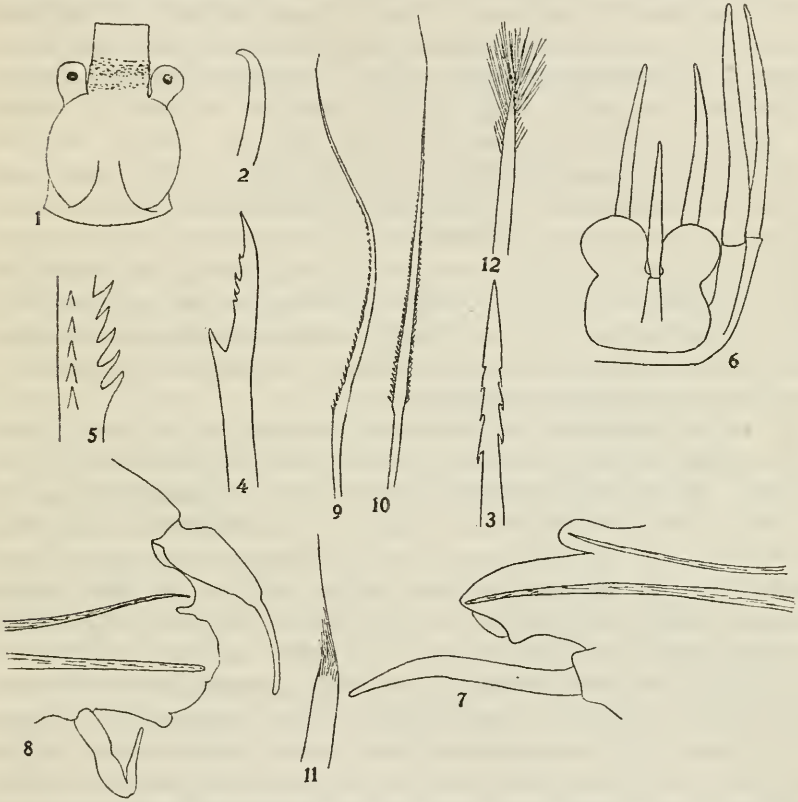
The prostomium (fig. 6), is rectangular in general outline, its breadth being only twice its length. The posterio-lateral angles are rounded, while the anterio-lateral ones are continued into the large sessile eyes which are distinguishable only by their form, any trace of pigment which might have been originally present having been lost. The ceratophore of the median tentacle arises near the posterior margin of the prostomium and extends to about the base of the eye stalks. The terminal joint is slender and tapering and extends about one-half its length beyond the eyes. The lateral tentacles arise from the extreme ventral face of the prostomium. They have about the same diameter as the median tentacle but are somewhat longer. The palps are slender but long and tapering, six or seven times as long as the prostomium. The dorsal tentacular cirrus is about one-half as thick and one-third as long, as the palp. The ventral tentacular cirrus is similar in form to the dorsal but smaller.

The first parapodium has a tuft of very slender setae arising just ventral to the tentacular cirrus. The second has a notopodium in the form of a rounded knob into which an acicula extends and a much larger neuropodium with rounded presetal and pointed postsetal lips. The acicula nearly reaches the surface between the lips. Dorsally there is an elytrophore and ventrally a cirrus which is much longer than the setal lobes. (Fig. 7.)

---

[5] Moore, J. Percy: Polychaeta from the Coastal Slope of Japan and from Kamschatka and from Bering Sea, Proc. Acad. Nat. Sci. Philadelphia, 1903, vol. 55, p. 422.

The third parapodium (fig. 8) is noticeably heavier than is the second. The notopodium is still a rounded knob with a tuft of thread-like setae. The ventral cirrus is relatively shorter than it is in parapodium 2. The dorsal cirrus widens suddenly from its attachment to the cirrophore and narrows again to an apex from which extends a finger-shaped process nearly as long as the basal portion.



Figs. 1 to 12.—Laetmonice nitida, new species. 1, prostomium × 20; 2, apex of notopodial seta × 250; 3, apex of large notopodial seta × 68; 4, apex of large neuropodial seta × 68; 5, detail of small neuropodial seta × 250. Eupanthalis evanida, new species. 6, prostomium × 15; 7, second parapodium × 45; 8, third parapodium × 45; 9, notopodial seta × 65; 10, another view of notopodial seta × 65; 11, large neuropodial seta × 65; 12, another form of neuropodial seta × 185.

Many of the setae are broken and some kinds occur on the second specimen which I could not find on the type, hence the following description includes only those that were actually seen. Other forms may have been lost and the distribution may not be accurately stated owing to losses in some somites. In anterior somites the notopodium carries a tuft of very long and delicate setae most of which have smooth margins but under high power (500 diameters) the larger ones may be seen to have toward the apex very faintly indicated marginal teeth along the curved edge. In my material these did not appear after the ninth parapodium. In its neuropodium the second parapodium carries a tuft of rather heavy setae curved toward the apices and provided with toothed plates along the apical region. All of these are broken and nothing can be said about their precise shape. Ventral to these is a tuft of slender colorless curved setae. From the point of curvature which is near the end, two series of minute teeth are continued along the border of the seta, this border being at first convex and later, owing to a second bending, concave. When seen in profile (fig. 9), only one row of teeth is visible. In full face (fig. 10), two rows can be seen. Under the comparatively low magnification of the drawing (× 65), these teeth appear as sharp spines. Under higher powers they show as small plates set at an angle to the shaft, and toothed at their free margins. In anterior somites these setae are inconspicuous, but behind the fifth parapodium they are larger, reaching as far as the heavy ones (to be described later). While the structure here remains essentially unaltered the stalks are much longer and heavier and often have a twisted or contorted appearance.

In the neuropodium of the third parapodium are heavy setae with slightly curved apices and in most cases the tip is more or less frayed. In the best preserved setae the tip is smooth hence it is probably that the fraying is always due to accident. They seem to have quite a different form from the large ventral ones in parapodium 1. In my material they occur only as far back as the thirtieth somite, developing in these later somites a very marked arrangement of hairlike process at the apex. (Fig. 11.) Setae of a still different form begin on the ninth parapodium in the type. These (fig. 12), have a slender stem with a dense tuft of bristles at the apex. The basal ones of these are arranged in rows of decreasing length but terminally they form an irregular tuft. They take the place of the thread-like notopodial setae of anterior somites and after about somite 30, they and the toothed variety are the only ones I could find.

There is little of diagnostic value in the few elytra remaining on the specimens. The anterior ones overlap on the same side of the body and the first one or two may perhaps meet across the dorsum. The margins are smooth but they are too much distorted by the preservation to show the original form. Their color is like that of the general surface of the body but no markings are to be seen even under considerable magnification.

Family HESIONIDAE

Genus HESIONE Savigny

HESIONE GENETTA Grube

Hesione genetta GRUBE, Jahresbericht der natur. Sect. der Schles. Gesellsch., 1866, p. 63; Annulata Semperiana, Mem. Akad. Imp. Sci. St. Petersbourg, vol. 25, no. 8, 1878, p. 104:

One specimen, collected in tide pool on Tobea Island.

Family NEREIDAE

Genus NEREIS Linnaeus

NEREIS MASALACENSIS Grube

Figures 13 to 17

Nereis masalacensis GRUBE, Annulata Semperiana, Mem. Akad. Imp. Sci. St. Petersburg, vol. 25, no. 8, 1878, p. 75, pl. 5, fig. 4.

On the assumption that the paragnath and tooth formula does not change in assuming the heteronereis phase, I have assigned to this species of Grube's a considerable number of heteronereids collected at Varadera Bay, Mindanao, identification being aided by some other points of agreement with Grube's description. Lateral brown streaks of pigment in anterior somites occur in the heteronereids as well as in the original material.

The prostomium (fig. 13) is nearly rectangular in outline, the middle half of the anterior margin being extended to form the tentacle bases. What are evidently the eyes appear as slight elevations on the lateral margins of the prostomium though because of a dense accumulation of pigment they are not definitely visible. This pigment is a dense purple in color, and except for a narrow median line on the dorsum extends over the entire dorsal surface of the prostomium, leaving the tentacles uncolored. The basal portion of the palp is uncolored, but its apex is pigmented, though of a lighter color than the prostomium.

In the specimen figured the protruded pharynx distorts the peristomium. In another this is seen to be distinctly biannular, and much shorter dorsally than ventrally. A rounded nuchal lobe extends from its anterior border over the posterior end of the prostomium. The peristomium is pigmented and each of the following 13 somites has on either side a pigment spot whose size becomes smaller successively from somite to somite. The postero-dorsal is the longest of the tentacular cirri, its apex in the male reaching to the twentieth somite or the end of the anterior body region.

In the male, the first 20 somites form the anterior body region. The first three dorsal cirri are acute oval in outline, with filamentous apices and the ventral ones are similar to them in form but are smaller. (Fig. 14.) The fourth and fifth cirri are more elongated but retain in general this distinction between the basal portion and the filamentous tip, while from the sixth to the twentieth the cirri are long and slender, reaching beyond the tips of the setae. (Fig. 15.) In these somites the setae lobes become heavier and blunter than farther forward but in other respects they do not noticeably differ.

In the modified region characteristic heteronereis changes appear as indicated in Figure 16.

In the anterior region of the male are two kinds of setae. The first, found in both noto- and neuropodium, has a long slender, camerated shaft and a very long delicate, terminal joint which narrows to a very sharp point and has a row of teeth along one margin. The second variety, found only in the neuropodium, is similar to the first in the form of its shaft, but the terminal joint is blunt-pointed and short, with a row of stiff spines along one margin. (Fig. 17.) These spines are as long as the transverse diameter of the main part of the terminal joint. In the modified portion the setae have the form characteristic of this state; a prominent camerated shaft and a broad, oval terminal joint toothed along one margin.

In the females the number of modified somites varies from 18 to 25. The females have a setal and parapodial structure essentially like those of the males except that the distinction between the first three, and the later dorsal cirri is much less marked. The larger female are about 35 mm. long and the males about 25 mm.

Family SABELLARIIDAE

MONORCHOS, new genus

Body-form characteristic of the family: Opercular lobes fused except for a shallow median ventral incision. On the margin of each opercular lobe is a single row of paleae, the two rows overlapping at their ventral ends but separated dorsally. A single pair of dark brown heavy hooks lies in the space between the dorsal ends of the rows of paleae. On the dorsal median surface of the fused opercular lobes are two rows, each three or four in number, of short, sharp dark brown spines, arranged in an inverted V with the apex near the margin of the ventral incision. On the ventral surface the opercular stalk is folded so as to form a deep groove leading back to the mouth. A single row of tentacles lies on either margin of this groove. Just anterior to the mouth is a pair of long palps, capable of being retracted into the groove.

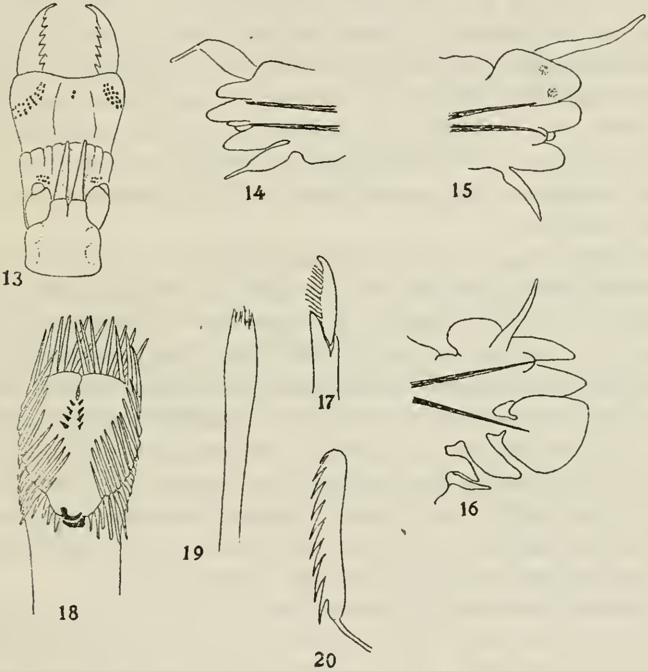
This differs from other genera in that it has only one row of paleae, the place of the inner row being taken by the V-shaped arrangement of hooks.

Genotype.—Monorchos philippinensis, new species.

MONORCHOS PHILIPPINENSIS, new species

Figures 18 to 20.

A number of individuals were collected at D 5526, between Siquijor and Bohol Islands, 9° 12′ 45″ N., 123° 45′ 30″ E., August 10, 1909, 805 fathoms, (one, the holotype, bears Cat. No. 1920 F, U.S.N.M.). Although none retained more than the anterior regions of the body, these are so characteristically different from other genera in this family that the formation of a new genus seems necessary.



Figs. 13 to 20, Nereis masalacensis Grube. 13, prostomium × 20; 14, third parapodium of male × 45; 15, tenth parapodium of male × 45; 16, modified parapodium × 45; 17, apex of compound seta × 250. Monorchos philippinensis, new species. 18, anterior end × 2.5; 19, thoracic setae × 45; 20, uncinus × 185.

The type of the species measures 25 mm. from the anterior end of the operculum to the beginning of the uncinigerous tori and has an opercular width of 6 mm. Except for the median ventral incision, the opercular lobes are completely fused, and their dorsal surfaces are smooth except for indistinct ridges starting from the margins and converging toward the postero-dorsal median margin, not shown in the figure. In some specimens the margins of the ventral incision are thickened and extend backwards as a sort of lip, as far as the V-shaped row of hooks, which are themselves sometimes carried on an elevation continuous with this lip. This structure does not show in all individuals and may be due to the preservation. On either side of the operculum is a row of paleae, about 18 on a side. The rows overlap ventrally but are separated dorsally by a considerable gap. (Fig. 18.) In this gap is a pair of very heavy hooks. Two rows of dark spines, grouped to form an inverted V lie on the dorsal surface of the operculum. There may be some variation in the number of these in each row; 3 or 4 were found in each of the individuals in this collection. A single row of flattened cirri, approximately equal in number to the paleae and about as long as these are, is attached to the margin of the operculum at the bases of the paleae. Dorsally they are continued, for three or four on a side, along a ridge which runs a little posterior to the level of the large hooks.

In preserved material, the two margins of the opercular stalks on their ventral faces, are almost in contact, inclosing the tentacles inside the groove thus formed. A single row of tentacles runs along each margin. So far as can be told from the preserved material, the tentacles have a length about equal to the diameter of the body. Two long palps arise just in front of the mouth. They have smooth surfaces, are circular in cross section, and taper to blunt points. In the type they are heavy and extend to a distance of 5 mm. from the surface of the body. In a much smaller specimen, they are very slender and extend to a distance of 15 mm. Apparently they are contractile and can be drawn into the ventral groove.

The first somite behind the mouth has a row of gills on either side. In the type, there are four of these on the left side, each shaped much like the opercular cirri and not much larger than they, and only two on the right side, one of these, however, being more than twice as broad as any of the others. The four following somites have each a small ventral seta tuft and a dorsal elevated torus carrying a row of heavy spines. The first of these tori is much the smallest. Behind this region each somite has smaller but very prominent tori and gills. The latter are too poorly preserved for accurate description, but are relatively long and narrow, tapering to an acute point and are pigmented. On the torus is a row of pectinate uncini.

The opercular paleae are light straw in color and apparently have rounded tips, though they were all badly broken in the material I had. The thoracic paleaelike setae have much the same form as these but are longer and more slender. They are faint straw color, with slight darkening toward the ends and apparently have normally acute tips, though in all that I could find these were frayed. (Fig. 19.) The uncinae of the thoracic tori (fig. 20), have 8 or 9 double rows of sharp hooklike teeth, of which the apical one is the smallest. Figure 20 is drawn in profile and shows only one row of the teeth. The base of the uncinus is prolonged into a very slender rod, whose length I was unable to determine with accuracy. It is certainly many times as long as the uncinus itself. Ventral to the torus is a tuft of fine setae of two sorts. One kind is long and slender and tapers to a very acute apex. The other is larger though still absolutely small and in the terminal one third of its exposed portion has minute plate-like teeth in two rows, along the margin. Similar fine setae occur in the seta tufts ventral to the tori carrying the large setae.

Family LEODICIDAE

Genus LYSIDICE Savigny

LYSIDICE COLLARIS Grube

Lysidice collaris GRUDE, Beschreib, neuer von Ehrenb. gesammelt Annel., Berl. Akad, Monatsber., 1869, p. 15; Annulata Semperiana, Mem. Akad. Imp. Sci. St. Petersbourg, vol. 25, no. 8, 1878, pp. 166, 167.

One specimen, doubtfully identified as belonging to this species, collected at Macassar Island.

REPORT ON THE HYDROIDA COLLECTED BY THE UNITED STATES FISHERIES STEAMER "ALBATROSS" IN THE PHILIPPINE REGION, 1907–1910

By Charles C. Nutting

Of the Department of Zoology of the State University of Iowa

INTRODUCTION

The territory covered by the dredging stations worked by the United States Fisheries steamer *Albatross* during her Philippine cruise of 1907–1910 was somewhat more extensive than the Philippine region proper, extending from the most northerly station which was in the China Sea, vicinity of Hongkong, latitude 21° 54′ N., longitude 114° 46′ E., which is some 500 miles northwest of the Philippines proper; the vessel worked as far south as Borneo near Sudakan at about latitude 4° 30′ S., longitude 118° E., which was also about the farthest west at which work seems to have been done and hydroids taken, with the exception of Hongkong. The extreme southern limit in the Philippines seems to have been at Tawi Tawi group of the Sulu Archipelago where stations were worked as far south as latitude 4° 58′ 20″ N., and the most southerly station of all yielding hydroids was in Macassar Strait, latitude 4° 43′ 22″ S. There was, therefore, a range of over 26° of latitude between the extreme northern and the extreme southern stations yielding hydroids.

It may be of interest to note the regions in which the most hydroids as indicated by the results of the dredging were found: China Sea, vicinity of Hongkong, at station 5310, five species were secured; at station 5311, six species; at station 5312, four species. In the Sulu Archipelago, vicinity of Siasi, hydroids were taken at all five hauls. Between Samar and Leyte, vicinity of Suriogo Strait, there were five hauls at which hydroids were taken.

The greatest depth represented by specimens in the collection was at station 5428, Eastern Palawan, 30th of June Island, N. 62°, W. 19.5°, depth 1,105 fathoms, where two species *Dictyocladium aberrans* and *Sertularella cornuta* were secured. *Stegopoma plicatile* was dredged from 441 fathoms at station 5529, 9° 23′ 45″ N., 123° 39′ 30″ E. *Zygophylax convallaria* came from a depth of 400 fathoms at station 5635, Pitt Passage, 10° 53′ 30″ S., 127° 39′ E.;

and *Zygophylax curvitheca* was from 400 fathoms, station 5664. Macassar Strait, 4° 31′ 22″ S., 118° 53′ 18″ E. Nearly all of the other hydroids secured during this cruise were from depths of less than 200 fathoms and most of them from under 50 fathoms.

Hydroids were taken at 58 of the 575 dredging stations reported for the cruise, which does not indicate an extraordinarily rich hydroid fauna.

The author takes pleasure in expressing his great obligation to Warren Keck, research assistant in zoology in the University of Iowa, for very efficient aid in the preparation of this paper, whereby the writer has been relieved of most of the drudgery of looking up references, preparing specimens for examination, verifying data regarding dredging stations, and looking up the literature regarding previous work on the Hydroida. Much of the accuracy of the paper is due to the care and fidelity with which Mr. Keck has discharged his duties as research assistant. The plates accompanying this paper are from drawings by Mr. Keck.

In the matter of classification the writer adheres in the main, so far as the families Campanularidae, Sertularidae, and Plumularidae are concerned, to the scheme adopted in his American Hydroids, Parts I, II, and III, although he has used some of the genera instituted by Stechow and has added one new genus, *Stechowia*. Stechow [1] has worked out an elaborate revision of the classification of the Hydroida in which he has divided the family Sertularidae into three new subfamilies, Thyroscyphinae, Sertomminae, and Sertularinae, largely on the basis of the presence or absence of an abcauline blind-sack in combination with certain characters of the hydrothecal margin. He recognizes 36 genera in this family of which 14 are new. He also reduces to synonymy a large number of generic names that have been established and almost universally used for generations, such as *Thuiaria*, *Desmoscyphus*, and *Monopoma*.

While I do not propose to enter into an adequate discussion of Doctor Stechow's work, I will say that it seems to me that some of his genera are based on characters that are not of generic rank, and in his new genus *Tridentata*, 1920, he has included a large number of heterogeneous forms that, in my opinion, are generically separate. In this single genus he has placed together species formerly belonging to the well-established genera, *Sertularia*, *Dynamena*, *Desmoscyphus*, *Thuiaria*, all of which seem to me to have generic rank. He places this heterogeneous lot under one genus because they have two lateral hydrothecal teeth and a small adcauline median tooth, together with a two-flapped operculum. The old genus, *Sertularia*, is practically identical with his *Tridentata* except in the possession of the small median hydrothecal tooth. This is so rudimentary that it has not affected the operculum, as in the case of truly tridentate forms such as found in the genus *Sertularella*, but his genus *Tridentata* has a two-flapped operculum such as is common in *Sertularia*. This seems to me to be a character not of generic value and I also believe that such a procedure tends to confuse rather than to simplify the situation.

---

[1] Zur Kenntnis der Hydroidenfauna des Mittelmeeres, etc., Parts I and II, 1919–1923.

Doctor Stechow is a very thorough and conscientious student of the Hydroida and his activity for the last few years has probably not been surpassed by any other worker in that group; but his multiplication of names and breaking up of old genera and recombination into new genera of the fragments of the old all tend, in my opinion, to confuse the situation. It is a deplorable fact that the systematists have fallen into more or less disrepute in the estimation of the morphologists and workers in other zoological fields on account of their continual rearrangement and disturbance of classification. This causes constant irritation, indeed exasperation, in the minds of those who are working in the general field, for the simple reason that it seems to them that there is no such thing as stability of names in zoology, although that has really been the aim of the systematists for many years. Doctor Stechow has made an earnest effort to comply with the rules of the International Commission on nomenclature, but even here he, in common with most European writers, does not adopt the rule that a species named after a person or a country should not be capitalized.

In his discussion of the Plumularidae, Doctor Stechow again divides the family into three subfamilies, Kirchenpauerinae, Plumularinae, and Aglaopheninae, based on the characters of the nematophores which are one-chambered in the first, free and two-chambered in the second, and fixed and two-chambered in the third. He recognizes a total of 44 genera, of which 12 are new.

Bedot[2] has undertaken a thorough systematic revision of the family Plumularidae. He does not recognize the subfamilies of Stechow and includes 32 genera in his discussion. He discards the genera *Antomma*, *Dentitheca*, *Plumella*, *Oswaldella*, *Pycnotheca*, and *Lytocarpia;* thus he declines to recognize exactly half of the new genera described by Stechow. This looks almost like a repercussion of the late war.

The present writer is not prepared to enter fully into this discussion, neither is this paper one in which it should figure. He must confess, however, a preference for a conservative course in nomenclature and is much averse to the abandoning of established genera or the formation of new ones unless such a course is rendered inevitable by situations so clear that an old genus is untenable or a new one practically unavoidable.

---

[2] Notes systématiques sur les Plumularides, two parts, 1921.

Among the most recent discussions of the classification of the Hydroida is that of Billard.[3] Billard somewhat severely criticizes Stechow's work, introducing his discussion as follows: "Depuis les travaux de Broch, un auteur allemand, Stechow, a compliqué les choses en créant de nouveaux genres, en débaptisant et rebaptisant certains genres, et ce d'une façon qui n'a pas toujours été heureuse et judicieuse."

He discards Stechow's genera *Dymella*, *Sertaria*, *Pasya*, *Tridentata*, *Lagenitheca*, *Nigella*, and indicates the doubtful validity of other genera established by that writer.

With such differences of opinion between authors of recognized authority it seems best to steer a conservative course. In this the present writer finds himself more in agreement with Bedot and Billard than with his distinguished colleague, Stechow. It seems that this conservative course is less likely to add to the confusion that prevails in our literature dealing with the classification of the Hydroida than would follow the adoption of the great number of nomenclatural changes instituted by Stechow.

SYSTEMATIC REVIEW OF THE HYDROIDS

[The asterisk (*) indicates a new species. The double asterisk (**) indicates a new genus, while the dagger (†) indicates species in which the gonosome is first described in this paper.]

- Gymnoblastic forms:
  - TUBULARIDAE.
    - *Branchiocerianthus imperator.* Japan.
  - EUDENDRIDAE.
    - *Eudendrium capillare.*
- Calypteroblastic forms:
  - HALECIDAE.
    - *Halecium lighti.*
  - CAMPANULARIDAE.
    - **Obelia thornelyi.*
    - *Thyroscyphus marginatus.*
  - CAMPANULINIDAE.
    - *Stegopoma plicatile.*
    - *Stegopoma gracilis.*
    - **Stegopoma dimorpha.*
  - HEBELLIDAE.
    - *Hebella contorta.*
    - *Hebella neglecta.*
    - **Hebella spiralis.*

---

[3] Note critique sur divers genres et espèces d'Hydroïdes, Revue Suisse de Zoologie, vol. 31, No. 2, May, 1924.

LAFOËIDAE.
- **Acryptolaria normani.*
- *Acryptolaria pulchella.*
- *Zygophylax rufa.*
- *Zygophylax convallaria.*
- *Zygophylax curvitheca.*

SERTULARIDAE.
- *Sertularia divergens.*
- *Thuiaria quadridens.*
- **Dictyocladium aberrans.*
- *Sertularella cornuta.*
- †*Sertularella mirabilis.*
- *Sertularella philippinensis.*
- *Idia pristis.*
- *Diphasia digitalis.*
- †*Diphasia huerteli.*
- **Diphasia inornata.*
- *Pasythea quadridentata.*

SYNTHECIDAE.
- *Synthecium tubithecum.*

PLUMULARIDAE.
- Eleutheroplean forms—
    - *Plumularia buskii.*
    - †*Plumularia aglaophenoides.*
    - **Plumularia flabellata.*
    - **Plumularia hargitti.*
    - *Plumularia dendritica.*
    - **Plumularia camarata.*
    - **Antennella biarmata.*
    - **Antennella recta.*
    - *Nemertesia cylindrica.*
    - **Antennopsis pacifica.*
    - †*Acanthella effusa.*
    - ***Stechowia armata.*
- Statoplean forms:
    - *Aglaophenia macgillivrayi.*
    - *Aglaophenia calycifera.*
    - *Aglaophenia urens.*
    - *Aglaophenia divaricata.*
    - **Aglaophenia triramosa.*
    - *Lytocarpus phoeniceus.*
    - *Lytocarpus spectabilis.*
    - *Lytocarpus pennarius.*
    - *Lytocarpus philippinus.*
    - *Lytocarpus balei.*
    - **Thecocarpus balei.*
    - *Halicornaria hians.*
    - **Halicornaria tenuirostris.*
    - **Halicornaria magnirostris.*

This table indicates that the specimens of hydroids in this collection represents 10 families, 27 genera, and 54 species. It includes 1 new genus, 17 new species, and 4 gonosomes not hitherto described and affords many new records of species not hitherto found in the Philippine region, thus increasing the known range of such forms.

One interesting feature of the collection is the relative scarcity of gymnoblastic forms, there being but three species belonging to this group, and one of these, *Branchiocerianthus imperator*, was dredged in Japanese waters and does not belong properly in this collection. On the other hand, 26 species, almost one-half of the total, belong to the one family, Plumularidae, and this family was divided almost equally between the eleutheroplean and statoplean forms, there being 12 of the former and 14 of the latter.

It is interesting to compare the general facies of this collection with that reported on by Doctor Hargitt,[4] which contained about 50 species, 13 of which were gymnoblastic and the remainder calypteroblastic forms and among the latter were but 7 species belonging to the family Plumularidae. This difference is doubtless due in part to the greater average depth of the stations worked by the *Albatross*, the Plumularidae usually thriving best in rather deep water. But the difference in the number of gymnoblastic forms represented in the two collections is hard to explain, although it may be due to a good deal of shore or tide-pool collecting in the case of the material reported on by Doctor Hargitt.

Family TUBULARIDAE

BRANCHIOCERIANTHUS IMPERATOR (Allman)

Monacaulus imperator ALLMAN, Challenger Reports, the Hydroida, pt. 2, 1888, p. 5.

The specimen secured by the *Albatross* is much smaller than those heretofore reported, but I find no good specific differences. The hydrocaulus is but 26 cm. long to the base of the hydranth. Height of hydranth 2 cm. and diameter 8 mm. One of the outstretched tentacles measures 7½ cm. in length. Compared with the enormous dimensions of the type specimen as recorded by Allman—hydranth 1½ inches, tentacles 4 inches long, with a stem 7 feet 4 inches high—the present specimen is relatively small, although it bears sexually mature gonophores.

The excellent descriptions and figures given by Stechow[5] agree very well with the specimen at hand except in size, his figure indicating a length of hydrocaulus of 85 cm.

In structure and characters of the proximal end of the hydrocaulus the *Albatross* specimen agrees very closely with that described by Stechow. The hydranth has been badly mutilated presumably by the dredge or trawl and the bilateral symmetry which Stechow gives as a character of this species is not evident. Allman, to be sure, did not mention this feature, neither is it indicated in his figures, but Mark, in 1898, studied the type specimen in the British Museum and noted its tendency toward bilateral symmetry.

---

[4] Hydroids of the Philippine Islands, 1924.

[5] Beiträge zur Kenntnis von *Branchiocerianthus imperator*, München, 1908.

The proboscis with the distal set of tentacles was torn off, but appears as a large fragment in the bottle containing the specimen and this fragment doubtless belong to the same specimen. The gonophores are much as described by Stechow, the older ones being generally ovate in form while the immature ones have a triangular profile as represented by him such as I have not seen in other species.

Locality.—Dredging station 4920, Musakaki Jima, N. 10° E., 17.5 miles (30° 34′ N.; 129° 22″ E.); depth, 440 fathoms.

Distribution.—The type specimen was found off Yokohama, Japan, at the great depth of 2,900 fathoms, and other specimens are mentioned by Stechow from Sagami Bay, Japan. Some of the specimens reported by him come from a depth of only 250 fathoms. Although this specimen was accidentally included in the *Albatross* material from the Philippine Islands, it seems to me that this brief note of it can occur here with the understanding that it is not as yet known from the Philippine Islands.

Family EUDENDRIDAE

EUDENDRIUM CAPILLARE Alder

Eudendrium capillare Alder, Cat. Zooph. Northumb. and Durham, 1857, p. 15, pl. 1, figs. 9-12.

The soft parts of the specimens secured by the *Albatross* are so matted together that details can hardly be ascertained. The following points, however, can be made out fairly well.

Trophosome.—Colony about 3 cm. high. Branches irregular, smooth for the most part, but often with about three annulations above their origin. Other branchlets or pedicels are often alternate, but not always so. Main stem quite smooth. The hydranth has the characteristic trumpet-shaped proboscis of the Eudendridae. The tentacles are all filiform and arranged in a single whorl around the base of the hydranth. They are quite numerous, at least 26 being counted in one case.

Gonosome.—Gonophores borne in clusters on the pedicels beneath the hydranths, the latter being sometimes more or less aborted. Both sexes appear on the same colony and in one case a cluster of male gonophores were on one side of a branch and one of female gonophores on the other. Both are of the characteristic *Eudendrium* type. The male gonophores are bithalamic in the single cluster found and thus agree with the original description of this species.

Locality.—Dredging station 5174, latitude N. 6° 03′ 45″, longitude E. 120° 57′, off Jolo light 2.6 miles; depth, 20 fathoms.

Distribution.—British Isles (Alder, Allman); Woods Hole, Mass. (Nutting); San Juan Archipelago (Fraser); Hawaii (Nutting); Japan (Stechow).

It seems to me likely that the *E. attenuatum* reported from the Philippines by Hargitt belongs to this species.[6]

Family HALECIDAE

?HALECIUM LIGHTI Hargitt

Halecium lighti HARGITT, Hydroids of the Philippine Islands, Philippine Journal of Science, vol. 24, No. 4, April, 1924, p. 489, pl. 4, fig. 13.

A fragmentary specimen which has evidently dried and is without recognizable soft parts is referred with doubt to this species. The stem is fascicled, as is very common in this genus; the branches are usually subalternate and regularly divided into internodes, each of which bears a sessile hydrophore much as figured by Hargitt so far as general shape is concerned. Contrary to his description, the series of "punctae" or round dots which encircle the hydrophore just below the margin is quite evident in the *Albatross* specimen.

Hargitt failed to find the "pair of extra large tentacles, some of which seemed to be armed with especially large nematocysts," which Light regarded as a specific character. He (Hargitt) says: "This detail of his description proved to be only partly true, large numbers of hydranths being entirely devoid of these specialized tentacles, some having but one, thus rendering the specific designation proposed very doubtful and even misleading." In his figure Hargitt represents the hydranths as being of the ordinary type for Halecidae. If these extraordinary tentacles are actually present the species should be made a basis for the description of a new genus.

In the absence of the gonosome the specific identity of this form seems to me to be extremely dubious. It is very much like *Halecium sessile* Norman as figured by Stechow.[7]

Locality.—Station 5149, off Sirun Island, 5° 33′ N., 120° 42′ 10″ E.; depth, 10 fathoms.

Distribution.—Port Galera Bay, Mindoro, "growing in strong currents flowing in and out of the bay" (Hargitt).

Family CAMPANULARIDAE

OBELIA THORNELYI, new species

Obelia serrulata (Bale) THORNELY, The Hydroid Zoophytes collected by by Doctor Willey in the Southern Seas. Willey's Zoological Results, pt. 4, Cambridge Univ. Press, 1899, p. 453, pl. 44, fig. 5.

I do not consider Miss Thornely correct in ascribing the species referred to above to the *O. serrulata* of Bale. The original description seems to me to refer to quite a different form.[8] Bale's description is as follows: "Hydrorhiza, slender, climbing, hydrothecae borne on long peduncles which spring either directly from other hydrorhiza or from the side of other peduncles; peduncles slender, with about 8–16 rings at the base and a less number (mostly two or three) at the summit, smooth throughout the rest of their length. Hydrothecae large, campanulate, constricted at the 'floor' which is raised above the base so as to inclose a nearly cylindrical cavity; margin, not expanding; armed with 10–14 rather large triangular-pointed teeth.

---

[6] The Philippine Journal of Science, vol. 24, No. 4, 1924, p. 474.

[7] Hydroidpolypen der japanischen Ostküste, pt. 2, 1913, p. 86, fig. 54.

"This is a delicate species with no proper stem, but the primary peduncles generally give origin to secondary ones exactly resembling them."

Miss Thornely, on the contrary, says that her specimen "is branched and has a straight compound stem formed by the downward growth of the peduncles of the hydrothecae."

As a matter of fact, this is a very common state of affairs as I have already shown.[9]

Locality.—Dredging station 5254, Gulf of Davao, off Linao Point, 7° 05′ 42″ N., 125° 39′ 42″ E.; depth, 21 fathoms.

Holotype.—Cat. No. 42173, U.S.N.M.

Distribution.—Blanche Bay, New Britain, 40 fathoms (Thornely).

THYROSCYPHUS MARGINATUS (Bale) not Allman

Campanularia marginata BALE. Catalogue of Australian Hydroid Zoophytes, 1884, p. 54.

Thyroscyphus marginatus BALE, Trans. and Proc. Royal Society of Victoria, 1914, new ser., vol. 27, p. 91.

Only a fragmentary specimen was found in the *Albatross* material. Fortunately, however, the peculiar squarish and four-toothed margin with its double border makes it reasonably certain that we have this species to deal with. After originally placing it in the genus *Campanularia*, Bale, the describer, placed it in the genus *Thyroscyphus*, a genus of Campanularidae, doubtless on account of its operculum, which he mentions indeed in the original description of 1884. So far as the present writer can ascertain, this species has hitherto been reported from Australian waters only, so that the specimen secured by the *Albatross* affords the first record from the Philippines.

As this form has never been adequately described, the following description is appended:

The largest fragment secured by the *Albatross* is 4½ cm. in height and the hydrorhiza is absent. The main stem is monosiphonic, fairly straight, without evident internodes, and reddish brown in color. The pinnae are also without evident internodes and are subalternate in position. Hydrothecae borne on main stem and pinnae and on very short pedicels, so short that the hydrothecae often appear to be sessile. Hydrothecae made of rather dense chitin, bell shaped, with a squarish margin which has two annular markings just below it. There are four large quite evident marginal teeth, as in many species of the genus *Sertularella*. In some cases the four-flapped operculum is quite distinct.

---

[8] Some New and Rare Hydroida in the Australian Museum Collection, Proceedings of the Linnean Society, New South Wales, vol. 3, ser. 2, 1888, p. 757, pl. 12, fig. 4.

[9] See American Hydroids, pt. 2, 1904, p. 6, and pt. 3, p. 4.

Gonosome.—Unknown.

Locality.—Dredging station 5149, Sulu Archipelago, vicinity of Sirun Island, 5° 33′ N., 120° 42′ 10″ E.; depth, 10 fathoms.

So far as the hydrothecae are concerned, this species comes very near *Sertularella*, the well-known Sertularian genus, and it may finally be placed there when the gonosome and soft parts are known.

Distribution.—Australia (Bale, Stechow).

Family CAMPANULINIDAE

STEGOPOMA PLICATILE (M. Sars)

Lafoea plicatilis Sars, Vidensk. Selsk. Forhandl., Christiania, 1862, p. 31.

Calycella plicatilis G. O. Sars, Vidensk. Selsk. Forhandl., Christiania, 1862, p. 117.

Stegopoma plicatile Levinsen, Meduser, Ctenophorer og Hydroider fra Grönlands Vestkyst, 1893, p. 36, pl. 6, figs. 1–7.

The best description and figures of this species that I have been able to find are by Levinsen in the last paper referred to above. Although M. Sars gives a fairly good figure which shows the characteristic features well. As I have not found a complete description of this species, it seems advisable to insert the following:

Trophosome.—Colony 8 cm. in height and with a spread of 4 cm. Stem and larger branches fascicled and bearing irregularly scattered hydrothecae between the branch origins. Ultimate branches simple and alternate. Hydrothecae sessile or even slightly immersed on main stem and branches and alternate on ultimate branches, standing at an acute angle with the stem or branch and considerably smaller than those of other species, being usually less than a mm. in height and practically sessile, each being borne on a shoulder of the branch. They are subtubular in shape, increasing gradually in diameter toward the aperture. Operculum much as in other species of this genus consisting of two pleated flaps like the roof of an "A" tent; there is a distinct diaphragm.

Gonosome.—Missing in the material secured by the *Albatross*, but according to Levinsen the gonangia are borne on the stem and main branches near the branch origins, are greatly elongated sacklike affairs lying almost parallel to the branches near the bases of which they arise.

Locality.—Dredging station 5529, between Siquijor and Bohol Islands, off Balicasag Island, 9° 23′ 45″ N., 123° 39′ 30″ E.; depth, 441 fathoms.

Distribution.—Norway (Sars), Greenland (Levinsen), Spitzbergen (Jäderholm), Kara Sea (Jäderholm), North Sea (Broch), Barents Sea (Thompson), Siberian Polar Sea (Jäderholm), Bering Sea (Jäderholm), East Coast United States (Verrill), Coast of Japan (von Marenzeller).

So far as the present writer knows, this is the first report of *S. plicatile* from Philippine waters.

STEGOPOMA GRACILIS Nutting

Stegopoma gracilis NUTTING, Hydroids of the Hawaiian Islands collected by the Steamer "Albatross" in 1902, U. S. F. C. Bulletin for 1903, pt. 3, 1905, p. 944.

Stegopoma medusiformis HARGITT, Hydroids of the Philippine Islands, 1924, p. 491, pl. 4, fig. 15.

Dr. Charles Hargitt in his paper on Hydroids of the Philippine Islands, (1924, p. 491) describes a new species which he calls *Stegopoma medusiformis.* In the synonymy following the name he mentions *Campanularia fastigiata* Alder, *Calycella fastigiata* Hincks, and *Stegopoma gracilis* Nutting. It is difficult for the present writer to understand why, if these are synonyms for his new species, *S. medusiformis*, he gives them another name. Bestowing a new name on a previously described species is only justified when the old name can be properly outlawed by virtue of the application of one of the well-known laws of nomenclature. Hargitt makes no attempt to justify his ignoring these names which he lists as synonyms. As a matter of fact, I can not see that either of the names that he gives is a synonym of his form, as a little study of *Campanularia fastigiata* Alder and of *Stegopoma gracilis* Nutting shows; the former having a distinctly fascicled stem and the latter having much smaller gonangia as compared with the hydrothecae than Hargitt's species.

But in completing his discussion of his *S. medusiformis* Hargitt says: "In general the species here described agrees very well with those referred to above, but it agrees more closely with that of Nutting, *Stegopoma gracilis;* yet there appear features which differ from it. I am disposed to suggest that on the basis of the distinctive medusoid characters and the larger size of the gonangia it be designated as a new species."

In other words, Hargitt first names *S. medusiformis* definitely as a new species; then he regards *S. fastigiata* and *S. gracilis* as synonyms, thus indicating that his form is not new and lastly he is "disposed to suggest" that it be designated as a new species. I can see no essential difference between *Stegopoma gracilis* and *medusiformis* and have therefore listed the latter as a synonym.

Localities.—Dredging station 5168, Sulu Archipelago, Tawi Tawi group, Observation Id., 4° 56′ 30″ N., 119° 45′ 40″ E.; depth, 80 fathoms. Station 5413, between Cebu and Bohol near Lauis Point, 10° 10′ 35″ N., 124° 3′ 15″ E.; depth, 42 fathoms. Growing on *Acryptolaria normani*, a new species presently to be described.

STEGOPOMA DIMORPHA, new species

Plate 40, figs. 1, 2, 3

Trophosome.—Colony not parasitic as in other species of the genus but branching in form and attaining a total height of 9 cm. Stem and main branches fascicled much as in *S. fasciata* (Johnston). Main branches irregularly disposed, but the ultimate branches are not fascicled and are quite irregularly alternate, with rarely somewhat indefinite nodes, and often annulated proximably. Pedicels of varying length, some being longer than the hydrothecae and others quite short so that the hydrothecae are practically sessile, but not actually so. The pedicels may be ringed or annulated throughout, quite smooth throughout, annulated proximally or annulated distally; but this latter condition is quite rare. Hydrothecae very large, tubular, slender, measuring as much as two mm. in length and 0.5 mm. in diameter. The margin is beveled on two sides so that the pleated operculum is in the shape of an "A" tent, a character of the genus. There is an evident diaphragm near the bottom of the hydrotheca.

Hydranths.—Well shown in the specimen described. The proboscis is not strictly conical as is usual in the genus, but approaches the trumpet shape of the Campanularidae, being often wider at its distal end, although it does not have the outward curve of the typical campanularian. There are usually about 16 tentacles, although these vary considerably in number.

Gonosome.—Gonangia about the same size as the hydrothecae and much the same shape, almost sessile, walls very delicate and transparent, so that the structure of the operculum is hard to make out, but it is of the "A" tent type. The blastostyle bears seven developing medusae in fully formed examples. The sex products are not developed sufficiently to disclose ova or spermatozoa. This type of gonangium is usually borne on the ultimate branches and not on the main stem or larger fascicled branches. The second type of gonangia, on the same colony as the others, is borne on the main fascicled stem. They are very much larger than the first kind, one of them measuring 3.1 mm. in length and 1 mm. in diameter. The walls are also much thicker and distinctly brownish yellow in color, like the thick chitin of the fascicled stem. They are considerably flattened distally and the "A" of the operculum is sharply pointed. Their contents are not sufficiently well preserved for description, but they have the appearance of containing old blastostyles from which the contents have escaped. One of these gonangia bears gonads which appear to be male and show no medusoid characters whatever. The two kinds of gonangia do not appear to intergrade, although each varies considerably in size.

This curious dimorphism of the gonangia has not been described before, so far as I know, in the Campanulinidae, nor indeed have I encountered it in the hydroids. Of course, there are forms with colonies bearing both male and female gonads, but I have not seen such a striking differenece in the gonangia of a single colony.

Locality.—The holotype, Cat. No. 42174, U.S.N.M., was dredged at station 5117, Balayan Bay and Verde Island Passage near Sombrero Island, 13° 52′ 22″ N., 120° 46′ 22″ E.; depth, 118 fathoms. This remarkable form is nearest to my *Stegopoma gilberti*[10] from which it differs in having many of the pedicels extensively annulated, in the shape of the proboscis, and in the two kinds of gonangia many of which are much larger than the hydrothecae instead of usually being shorter as in *S. gilberti.*

Family HEBELLIDAE

HEBELLA CONTORTA Marktanner-Turneretscher

Hebella contorta MARKTANNER-TURNERETSCHER. Die Hydroiden des k. k. naturhistorischen Hofmuseums, 1890, p. 215.

This species is reported by the original describer and also by Doctor Hargitt as occurring on *Idia pristis*, and is parasitic on that species in the *Albatross* material which forms the basis for this paper. The hydrothecae vary greatly, sometimes being almost straight cylinders, but many having the twisted appearance reported and figured by Marktanner-Turneretscher.

Locality.—Dredging station 5146, Sulu Archipelago near Sulade Island, 5° 46′ 40″ N., 120° 48′ 50″ E.; depth, 24 fathoms.

Distribution.—Type from Singapore Museum. Reported from Philippines also by Doctor Hargitt.

---

[10] Hydroids of the Hawaiian Islands. U. S. Fish Commission Bulletin for 1903, pt. 3, p. 943, Dec. 23, 1905.

HEBELLA NEGLECTA Stechow

Hebella neglecta Stechow, Zur Kenntnis neuer oder seltener Hydroidpolypen, etc., 1914, p. 139.

Our specimens answer very well to Stechow's description and figures, having large cylindrical hydrothecae with everted rim and noncorrugated walls. The pedicels are short and not annulated.

Gonosome.—Not known.

Locality.—Dredging station 5413, between Cebu and Bohol, near Lauis Point, 10° 10′ 35″ N., 124° 3′ 15″ E.; depth, 42 fathoms. Growing on *Acryptolaria normani.*

Distribution.—Uraga Kanal, Japan (Stechow).

HEBELLA SPIRALIS, new species

Plate 40, figs. 4, 5, 6

Colony parasitic, growing as a creeping root stalk over a large pinnate sertularian hydroid, completely invading all its stem and branches.

Trophosome.—Hydrocaulus simple, sinuous in its course, and sending off usually alternate hydrothecae. On the main stem of the host this parasitic root stalk forms an intricate network of delicate often anastomosing pattern. Hydrothecae irregularly scattered on the main stem of the host but tending to be opposite on the pinnae, although this feature is by no means constant. The hydrothecae are in the form of spirally twisted tubes, in some cases there being about one and one-half turns to the spiral, and there is great variation in the closeness of the twist, some being rather tightly coiled and others drawn out into a very loose spiral. The aperture is normally round and the rim even. There is sometimes, not by any means always, a thickening of the rim and a small but evident diaphragm at the bottom of the hydrotheca separating its cavity from that of the pedicel. Pedicel very short and broad, but evident. Owing to the torsion of the hydrothecae the pedicel is hard to see under ordinary circumstances. When the root stalk from which they spring is on the upper surface of a pinna the hydrothecae are twisted around so as to face downward.

Locality.—Dredging station 5477, between Samar and Leyte, vicinity of Surigao Strait, Tacbuc Point, 10° 44′ 45″ N., 125° 12′ 30″ E.; depth, 48 fathoms.

Holotype.—Cat. No. 42175, U.S.N.M. This form is nearest to *Hebella contorta* Marktanner-Turneretscher[11] from Singapore, from which it differs in a much greater torsion of the hydrothecae, which, according to the figures given by the describer, are but slightly twisted, not curved in a spiral as those of *H. spiralis.*

---

[11] Die Hydroiden des k. k. naturhistorischen Hofmuseums, Vienna, 1890, p. 215.

This species is remarkable for the pronounced torsion of its hydrothecae. The extent of the colony, if it is a single colony is enormous, as it spreads over the entire surface of stem and branches of a plume-like sertularian 18 cm. in height, and there must be many thousands of the hydrothecae.

Family LAFOËIDAE

ACRYPTOLARIA NORMANI, new species

Plate 41, figs. 1, 2

Trophosome.—Colony pinnate, 4½ cm. high and with a spread of 1½ cm. Stem and branches, except at their distal ends, fascicled and consisting of a central hydrothecate tube surrounded by a number of others destitute of hydrothecae. Branches subalternate, on opposite sides of the stem, projecting from the stem almost at right angles. Those near the proximal end of the colony are fascicled almost to their tips, while those at the distal end are simple, almost throughout and without evident nodes. Hydrothecae on the main stem are usually more or less immersed, two of them being found between two adjacent branch bases. Those on the branches are alternate and on opposite sides, adnate to the branch for most of their length up to the bend, but those on the tips of the colony are free for a considerable part of their length. The hydrothecae are tubular but abruptly bent outward near their distal ends so that their apertures are at right angles to the main body or even face slightly downward, on the under side is a bend at a right angle or even a reentrant curve. The rim is ornamented by two, sometimes three, circular ridges which are quite conspicuous. There is a distinct diaphragm near the bottom of the hydrotheca and the hydrothecae taper gradually into the tube from which they spring.

Nematophores.—There are a few nematophores irregularly scattered over the branches but they seem to have no very constant relation to the hydrothecae.

Gonosome.—Gonangia cylindrical about as high as the hydrothecae but almost three times as broad, being three-fifths as wide as high. Basal part curving roundly to the stem on which it appears to be sessile. Only three were found and one was on the proximal part of the stem. It is barely possible that these belong to a parasitic hydroid, several of which were found on the specimen studied, but they appear to be organically connected with the colony of *A. normani.*

The presence of nematophores on this form is quite confusing and tends to show that their systematic importance is not great.

Localities.—This species was secured by the *Albatross* at dredging station 5413, between Cebu and Bohol, at Lauis Point, 10° 10′ 35″ N., 124° 3′ 15″ E.; depth, 42 fathoms. Station 5355, North Balabac Strait, Balabac Light, 8° 8′ 10″ N., 117° 19′ 15″ E.; depth, 44 fathoms.

The holotype from station 5413 bears Catalogue No. 42176, U.S.N.M.

ACRYPTOLARIA PULCHELLA (Allman)

Cryptolaria pulchella ALLMAN, Challenger Reports, the Hydroida, Part 2, 1888, p. 40.

Cryptolaria pulchella STECHOW, Hydroidpolypen der japanischen Ostküste, Part 2, 1913, p. 112.

This species should be placed in Norman's genus *Acryptolaria* after the scheme adopted by Stechow.[12] The specimens secured by the *Albatross* show great variation in the hydrothecae, particularly in the distance between adjacent ones, but many are quite typical of the species as described by Allman and the present writer.

Gonosome.—Not present in the specimen secured.

Locality.—Dredging station 5168, Sulu Archipelago, Tawi-Tawi group, Observation Island, 4° 56′ 30″ N., 119° 45′ 40″ E.; depth, 80 fathoms.

Distribution.—Hawaiian Islands (Allman, Nutting), where it is a very abundant form; Japan (Stechow); Pacific coast off Panama (Clarke).

ZYGOPHYLAX RUFA (Bale)

Campanularia rufa BALE, Catalogue of the Australian Hydroid Zoophytes, 1884, p. 54, pl. 1, fig. 1.

Zygophylax rufa (BALE), Proc. Royal Society of Victoria, vol. 27, new ser., pt. 1, 1914, p. 90.

As this appears to be the first report of this species from the Philippines and as references to it are few and the original description rather scant, the following fuller description may be serviceable:

Trophosome.—Colony 7 cm. high, spread 7½ cm., flabellate in form. Main stem quite straight, fascicled, apparently without internodes and bearing an occasional hydrotheca; color, reddish or orange brown. Branches on opposite sides of the stem, subalternate, the main ones fascicled and colored like the stem. Pinnae on opposite sides of the stem and branches, subalternate in arrangement, not ordinarily divided into internodes and quite straight. Hydrothecae subcylindrical, 0.75 mm. high, 0.48 mm. in diameter. They are quite rigid, the inner side somewhat curved proximally while the outer side is nearly straight; margin, perfectly smooth, circular, with a fine annular line or marking just below. Pedicels usually of a single internode or rarely of two small ones, internodes often more or less oblique. The pedicel is borne on a short shoulder-like projection of the branch or pinna. Hydranths, not sufficiently well preserved for description, but apparently of the ordinary campanularian type.

---

[12] Zur Kenntnis der Hydroidenfauna des Mittelmeeres, Amerikas und anderer Gebiete, pt. 2, 1923, p. 137.

Gonosome.—Not known.

Localities.—Dredging station 5149, Sulu Archipelago, vicinity of Siasi, 5° 33′ N., 120° 42′ 10″ E.; depth, 10 fathoms. Station 5310, China Sea, vicinity of Hongkong, 21° 33′ N., 116° 13′ E.; depth, 100 fathoms.

Distribution.—Bale reports it from Holbrun Island 20 fathoms (Mr. Haswell). G. Conrad Bartlett published a list of species, including *Campanularia rufa*, in the Geelong Naturalist (No. 35, April, 1907, p. 41), but does not give the localities at which the specimens were collected.

This species differs from *C. marginata* Allman in having a fascicled stem and from *C. subrufa* Jäderholm in the general absence of nodes on the pinnae or ultimate branches.

ZYGOPHYLAX CONVALLARIA (Allman)

Lafoëa convallaria Allman, Hydroida of the Gulf Stream, 1877, p. 12.

So far as I can ascertain this is the first time this very beautiful hydroid has been reported since it was originally described by Allman. As several additional characters are shown in the specimens collected by the *Albatross*, the following description is offered.

Trophosome.—Colony 10 cm. in height and with a spread of about 7 cm. Stem and main branches fascicled. At or near the bases of the stem and larger branches a number of delicately branched structures appear which are probably phylactogonial in their nature. There are also scattered very slender, tubular offshoots that are probably elongated nematophores. Main branches subalternate or opposite. Ultimate branches subalternate and not divided into internodes. Hydrothecae all on one side of the ultimate branchlets but inclined alternately to right and left, very gracefully curved upward and outward from their pedicels, the curve being much like that of a sickle, forming one of the most graceful hydrothecae that the writer has ever seen. They are somewhat swollen at the base and narrow distally, ending in an even circular margin which is sometimes reduplicated. There are usually two hydrothecae on the main branch between adjacent alternate branchlets. The pedicels vary greatly in length, the hydrothecae on the main stem and proximal parts of the main branches being almost sessile, while those on the ultimate branches often have pedicels almost or quite as long as the hydrothecae. Nematophores are small, inconspicuous, and sparsely distributed. They have a tendency to occupy a position on the pedicels on stem near the base of the hydrothecae.

Gonosome.—Not known, but the branch structures referred to above probably indicate that there is a coppinia mass similar to that of *Lictorella cervicornis* Nutting.[13]

Locality.—Dredging station 5635, Pitt Passage at Gomomo Island. 1° 53′ 30″ S., 127° 39′ E.; depth, 400 fathoms.

Distribution.—The type was taken off Florida reef from a depth of 152 fathoms. This species is nearest *Lictorella cervicornis* Nutting, from which it differs in the curvature of the hydrothecae and their lateral position. It differs from *Zygophylax curvitheca* Stechow in having the hydrothecae bent but not twisted and in the much longer pedicels.

ZYGOPHYLAX CURVITHECA Stechow

Plate 41, fig. 3

Zygophylax curvitheca Stechow, Neue Genera thecates Hydroiden und Neue Species von Thecaten aus Japan. December 2, 1913, p. 139.

This handsome species was originally described by Stechow, who found it in a collection from Japan. His specimens did not show the gonosome and it is fortunate that the *Albatross* material contains specimens which show this feature in a very satisfactory manner. The Philippine specimen is described as follows:

Trophosome.—Colony flabellate in form, 3½ cm. in height, and with a spread of 2 cm. Stem fascicled, branches simple and subalternate. Branches are almost at right angles to the stem and not divided into internodes. Hydrothecae, one on the main stem just above the branch origins and another almost midway between adjacent branches, sessile. Those on the branches are strictly alternate, almost sessile, with basal chambers blending insensibly into the very short pedicel, if such it may be called. Hydrothecae tubular, the distal portions being bent toward the front of the stem and branches resembling the figure given by Allman for his *Lafoëa convallaria* from the Gulf Stream,[14] except that Allman's species had distinct pedicels more than half the length of the hydrothecae. The hydrothecal margins are often delicately rimmed. There is usually a nematophore near the base of each hydrotheca and others scattered along the branches and tubes of the fascicled stem. These are minute and tubular in form on the stem, but on the branches with enlarged distal ends, much like those in the Plumularidae. Many of the nematophores are broken off and those on the stem are shorter and less numerous than reported by Stechow.

Gonosome.—Gonangia aggregated into a coppinia mass, as conjectured by Stechow, on the proximal part of the main stem. They are shaped something like an anchor with a very strong, stubby shank and the two flukes ending in apertures which open in opposite directions; that is, if a gonangium is lying on one of its broad sides, one opening is directed upward and the other downward. Interspersed between the gonangia of the coppinia mass are normal hydrothecae and a few straggly, irregular, branchlike structures with neither hydrothecae nor nematophores.

---

[13] Hydroids of the Hawaiian Islands, 1905, pl. 10, fig. 8.

[14] Memoirs of the Museum of Comparative Zoölogy, vol. 5, No. 2, 1877, pl. 9.

Locality.—Dredging station 5664, Macassar Strait near Kapoposang, lat. 4° 43′ 22″ S., long. 118° 53′ 18″ E.; depth, 400 fathoms.

Distribution.—Sagami Bay, Japan, 600 meters (Stechow).

This species is very close to one described by me under the name *Lictorella cervicornis* from Hawaii,[15] which differs from it in having more nearly sessile hydrothecae and in having branches or phylactogonia resembling deer horns, arching above the gonongia and suggesting the name "*cervicornis*."

Family SERTULARIDAE

SERTULARIA DIVERGENS (Lamouroux) according to Bale [16]

Dynamena divergens LAMOUROUX, Histoire des Polypiers Coralligènes flexibles, 1816, p. 180.

(?) *Sertularia dubia* HARGITT, Hydroids of the Philippine Islands, 1924, p. 494.

The species dredged by the *Albatross* agrees quite closely with the description by Bale of *Sertularia divergens* (Lamouroux), but neither agrees with the figures given by Lamouroux, which are very inaccurate, but our specimen as well as Hargitt's description agrees very closely with Bale's description and it is probably the same species that the latter author regards as *S. divergens.*

In this connection it seems desirable to point out the fact that Hargitt's name for another new species *Sertularia minuta* can not hold, as that name is preoccupied by Bale in his work "On the Hydroids of Southeastern Australia, etc." (1881, p. 90), in which he gives the name *Sertularia minuta* to an extremely different species, which name must have the priority.

I do not propose a new name for this form *S. minuta* of Hargitt, because it is extremely likely that it is the same species that was described by Bale under the name *Sertularia tenuis.*[17]

Locality.—Dredging station 5413, between Cebu and Bohol, Lauis Point, 10° 10′ 35″ N., 124° 3′ 15″ E.; depth, 42 fathoms.

Distribution.—Australia (Bale), several localities cited; (?) Philippine Islands (Hargitt).

---

[15] Hydroids of the Hawaiian Islands, U. S. Fish Commission Bulletin, 1903, pt. 3, 1905, p. 946, pl. 10, figs. 5–9.

[16] Australian Hydroid Zoophytes, 1884, p. 81, pl. 5, fig. 3; pl. 19, fig. 16.

[17] Catalogue of the Australian Hydroid Zoophytes, 1884.

THUIARIA QUADRIDENS Bale

Thuiaria quadridens Bale, Australian Hydroid Zoophytes, 1884, p. 119, pl. 7, figs. 5, 6.

Thuiaria quadrilateralis Hargitt, Hydroids of the Philippine Islands, 1924, p. 493, pl. 5, fig. 17.

The specimens secured by the *Albatross* are very much like those described by Bale in detail, although their manner of growth is parasitic, being found on a plumularian hydroid and growing from a creeping root stalk from which erect and undivided branches arise. The details of the hydrothecae, however, appear to correspond quite exactly with *T. quadridens*, and I therefore feel it best to refer it to that species.

The figures given by Bale and Hargitt are so nearly identical that I have little hesitation in relegating *T. quadrilateralis* to synonymy.

Gonosome.—This was found by Hargitt on his specimens and described as follows: "Gonangia large, several times the size of the hydrothecae, and a four-sided shape, borne on short pedicels of pinnae, none on stems of my specimens."

Locality.—Dredging station 5251, Gulf of Davao, Linao Point, 7° 5′ 12″ N., 125° 39′ 35″ E.; depth, 28 fathoms.

Distribution.—Australia, Port Curtis (Bale); Philippine Islands (Hargitt).

DICTYOCLADIUM ABERRANS, new species

Plate 41, figs. 4, 5

Trophosome.—Colony 8 cm. in height and with a spread of 3½ cm., flabellate in form. Main stem fascicled proximally, but simple for the greater part of its length, without nodes; branches alternate.

Hydrothecae in pairs, the pairs being separated by more than their height and the bases of the individual hydrothecae are nearly contingent proximally but divaricate distally. On the main stem the hydrothecae are arranged so that there is one above and one below each branch origin and one opposite each branch origin. Occasionally there are three hydrothecae in a whorl and on one branch there are uniformly four of them in a whorl. The individual hydrothecae are flask-shaped with the distal ends curving gracefully outward, the margin square and with four low teeth as in many species of *Sertularella*, and there are also annular marks ("Ringfalte" of Stechow) around the margin. Operculum of four equal triangular flaps.

Gonosome.—On another specimen a single gonangium was found. It is extremely elongated, almost cylindrical in shape, about four times as long as wide, with walls distinctly but not deeply annulated, distal part narrowing insensibly into a broad marginal collar. The margin is impaired and seems to have four teeth.

Localities.—The holotype, Cat. No. 42177, U. S. N. M., was secured at dredging station 5593, Sibuko Bay, Borneo and vicinity, Mount Putri, 4° 2′ 40″ N., 118° 11′ 20″ E.; depth, 38 fathoms. The specimen upon which the gonangium was found was from dredging station 5428, Eastern Palawan and vicinity, 30th of June Island, 9° 13′ N., 118° 51′ 15″ E.; depth, 1,105 fathoms. This is one of the greatest depths at which specimens were secured on that cruise. Other stations were 5641, Buton Strait, 4° 29′ 24″ S., 122° 52′ 30″ E.; depth, 39 fathoms; and 5255, Gulf of Davao, Dumalag Island, 7° 3′ N., 125° 39′ E.; depth, 100 fathoms.

This species goes most reasonably into the genus *Dictyocladium*, agreeing with it in having a four-flapped operculum in the absence of an abcauline blind sack and in having the hydrothecae in more than two rows.

The appearance of three or four hydrothecae in a whorl is rare and may perhaps be regarded as an abnormality, but it appears the normal arrangement. The specimen from Davao Bay found growing on pearl oysters agrees with the form described above in the characters of the stem, branches, and form of hydrothecae. It differs in having the hydrothecae regularly in whorls of four, a character found in some of the branches of the specimen already described. At first when examining the specimen from Davao Bay I was inclined to consider it the representative of a new genus, but when the other specimens disclosed hydrothecae disposed in pairs, in threes, and in fours, sometimes all on the same branch, the idea of a generic distinction was abandoned, and it seemed best to place it in the genus *Dictyocladium*.

SERTULARELLA CORNUTA Stechow

Plate 42, figs. 1, 2

Sertularella cornuta Stechow, Neue Hydroiden der Deutschen Tiefsee-Expedition, nebst Bemerkungen über einige andere Formen, 1923, p. 12.

Sertularella polyzonias, var. *cornuta* Ritchie, The Hydroids of the Indian Museum, No. 1, 1910, p. 10.

Trophosome.—Colony 5½ cm. in height, pinnate in form, 4 cm. spread from tip to tip. Main stem simple, slightly sinuous, divided into regular internodes, each giving off a branch from near its proximal end and three hydrothecae, one opposite, one above, and one below each branch. Branches alternate and projecting from the stem at almost a right angle. They are quite straight, divided into irregular internodes, particularly near their distal ends, each internode bearing from two to four hydrothecae. Hydrothecae rather closely approximate, the top of one being opposite the base of the one next above it. They are in the shape of a bent flask swollen proximally, the distal one-third being free and bending outward from the branch.

The aperture is square, often several times reduplicated as in Ritchie's figure. Margin with four rather prominent teeth and operculum with four flaps.

Gonosome.—Gonangia fusiform, regularly and deeply annulated with a quadrate collar from the corners of which four conspicuous horns project horizontally as is well represented by Ritchie's figure.

Localities.—Dredging station 5428, Eastern Palawan and vicinity, 30th of June Island, 9° 13′ N., 118° 51′ 15″ E.; depth, 1,105 fathoms. Station 5642, Buton Strait, Tikola Peninsula, 4° 31′ 40″ S., 122° 49′ 42″ E.; depth, 37 fathoms.

A comparison of this species with typical *S. polyzonias* from Cape Cod shows very material differences in the trophosome. The hydrothecae of *polyzonias* are fully twice as long as in *cornuta* and are much more distant from each other. The colony of *S. polyzonias* is branched in a very straggling and irregular manner instead of being irregularly pinnate as in *S. cornuta*. The differences between the gonangia have been noted by Ritchie.

SERTULARELLA MIRABILIS Jäderholm

Plate 42, figs. 3, 4

Sertularella mirabilis JÄDERHOLM, Ueber Aussereuropäische Hydroiden des Zoologischen Museums der Universität Upsala, 1896, p. 9, pl. 2, fig. 1.

I have been unable to find any account of this truly remarkable sertularian subsequent to the original description by Jäderholm and feel that a description including that of the gonosome, which I believe to be hitherto unknown, will be well worth while.

Trophosome.—The colony is cylindrical in form, resembling a sponge, 10 cm. high and 1½ cm. in diameter. The main stem is distinctly fascicled proximally for about 8 mm. It then breaks up abruptly into a perfect maze of short slender profusely anastomosing branches and branchlets which are indistinguishable from each other and form a close network or web, a cylindrical mass of intricately interwoven branches. The whole thing resembles in miniature what is known as the "vegetable sponge" in tropical America. The branching is so irregular as to defy description, there being apparently no internodes and the branches often changing direction at abrupt angles at which single hydrothecae often are found. Hydrothecae alternate as a usual thing and quite distant, although the anastomoses are so frequent that there are seldom more than three hydrothecae between forkings. Often the meshes inclose fairly regular hexagons. Hydrothecae rather small, those in the forkings having the form of truncated cones. The branchlets often terminate in a hydrotheca which is hardly greater in diameter than the branch that bears it as if on a pedicel. Lateral hydrothecae are almost barrel-shaped, but larger below and plainly annulated throughout. The margin is square with four low teeth and a four-flapped operculum.

Gonosome.—The gonangia are small, about one and one-half times the length of the hydrothecae. They grow in clusters on the branches, are ovate in form with four or five very irregular annular corrugations, margin round and borne on a shallow hardly evident collar. These gonangia are not so regular and symmetrical as is usual in this genus, perhaps on account of crowding in the mesh-work of the branches.

Localities.—Dredging station 5310, China Sea, vicinity of Hongkong, 21° 33′ N., 116° 13′ E.; depth, 100 fathoms. Station 5311, same locality, 21° 33′ N., 116° 15′ E.; depth, 88 fathoms. Station 5312, same locality, 21° 30′ N., 116° 32′ E.; depth, 140 fathoms.

Distribution.—The type locality is Hirudostrasse, Japan, 33° 30′ N., 129° 18′ E.: depth, 45 fathoms. The writer has not seen any further report of distribution of this remarkable species.

SERTULARELLA PHILIPPINENSIS Hargitt

Sertularella philippinensis HARGITT, Hydroids of the Philippine Islands, 1924, p. 496, pl. 6, fig. 22.

The specimens described by Hargitt agree very well with those collected by the *Albatross*. The following points not mentioned by Hargitt may be noted:

The main stem is unbranched for about half its length and is very clearly annulated or corrugated proximally, the corrugations becoming less numerous distally until they appear in distant pairs. In the branched portion of the stem there are distant irregularly spaced corrugations which tend to appear just above each branch. The margin of the hydrothecae often bears a thickened rim, but is without reduplication. The gonangia are much as described by Hargitt, but the teeth are often not nearly so prominent as figured by him, although there is an occasional one that would be represented very well by his drawing.

Localities.—Dredging station 5310, China Sea, vicinity of Hongkong, 21° 33′ N., 116° 13′ E.; depth, 100 fathoms. Station 5311, same general locality, 21° 33′ N., 116° 15′ E.; depth, 88–100 fathoms.

Hargitt's localities are not designated except by station numbers, neither is there any indication of the depth from which specimens were taken.

IDIA PRISTIS Lamouroux

Idia pristis LAMOUROUX, Histoire des Polypiers coralligênes Flexibles, 1816, p. 199.

This well-known species is abundantly represented in the collection under discussion and has been described by many authors since the original discovery in 1816. It, therefore, needs no further description here.

Localities.—Dredging station 5097, China Sea, 14° 15′ 15″ N., 120° 33′ 52″ E.; depth, 30 fathoms. Station 5100, China Sea off Southern Luzon, Corregidor Light, 14° 17′ 15″ N., 120° 32′ 40″ E.; depth, 35 fathoms. Station 5134, Sulu Archipelago, 6° 44′ 45″ N., 121° 48′ E.; depth, 25 fathoms. Station 5146, Sulu Archipelago near Siasi, Sulade Island, 5° 46′ 40″ N., 120° 48′ 50″ E.; depth, 24 fathoms. Station 5221, between Marinduque and Luzon, 13° 38′ 15″ N., 121° 48′ 15″ E.; depth, 193 fathoms. Station 5248, Gulf of Davao, Lanang Point, 7° 7′ 25″ N., 125° 40′ 24″ E.; depth, 18 fathoms. Station 5400, North of Cebu, 11° 24′ 24″ N., 124° 5′ 30″ E.; depth, 25 fathoms. Station 5413, between Cebu and Bohol, 10° 10′ 35″ N., 124° 3′ 15″ E.; depth, 42 fathoms. Station 5479, between Samar and Leyte, 10° 47′ 15″ N., 125° 17′ 50″ E.; depth, 62 fathoms. Station 5481, same locality, 10° 27′ 30″ N., 125° 17′ 10″ E.; depth, 61 fathoms.

General distribution.—Almost world wide in tropical and temperate oceans, especially in the eastern part of the Pacific, where it has been reported as far south as New Zealand. It has also been reported by Allman from Bahia, Brazil, and the South Atlantic Ocean.

DIPHASIA DIGITALIS (Busk)

Sertularia digitalis Busk, Voyage of the *Rattlesnake*, vol. 1, 1852, p. 387.

Desmoscyphus longitheca Allman, Mem. Mus. Comp. Zoöl., vol. 5, no. 2, 1877, p. 26.

Diphasia digitalis Bale, Australian Hydroid Zoophytes, 1884, p. 101.

This well marked species was first described more than 70 years ago and has since been reported from various localities in both the Atlantic and Pacific Oceans. The specimens secured during the Philippine cruise of the *Albatross* are quite characteristic, although the gonosome is absent.

Locality.—Dredging station 5163, Sulu Archipelago, Tawi Tawi group, Observation Island, 4° 59′ 10″ N., 119° 51′ E.; depth, 28 fathoms.

Distribution.—Prince of Wales Channel, Torres Strait, 9 fathoms, West Indies (Allman, Nutting); off Bahia, Brazil (Allman), 10 to 20 fathoms; several *Albatross* stations in the North Atlantic, including West Indies down to 213 fathoms; Philippine Islands (Hargitt); Australia (Stechow).

DIPHASIA HEURTELI Billard

Plate 42, figs. 5, 6, 7

Diphasia heurteli Billard, Note critique sur divers genres et espèces d'Hydroïdes, 1924, p. 67.

As the gonosome was not present on the type specimen described by Billard and as we have abundant material both of the trophosome and gonosome, it seems best to give a detailed description of the species here in spite of some repetition so far as the trophosome is concerned.

Trophosome.—Colony growing as a parasite on a plumularian hydroid, *Aglaophenia triramosa* Nutting, over which it has ramified extensively. Hydrocaulus in the form of a creeping root stalk from which straight branches or hydrocladia arise at irregular intervals and attain a height of about 3 cm. There is a slight constriction below each pair of hydrothecae. Hydrothecae in pairs, tubular, gracefully bent outward to their distal ends, about two-thirds of their length being adnate to the branch. The bend is not angular but forms an even graceful curve. Aperture almost horizontal, and, therefore, opening upward, with a distinct operculum composed of a single adcauline flap which fits down below the hydrothecal margin on the abcauline side. The hydranths are not sufficiently well preserved for description.

Gonosome.—Gonangia arranged in a single row along one side of the branches. They are quite ornate in appearance and very unsymmetrical and their extreme transparency renders description extraordinarily difficult. Those on our specimen contain ova in what appears to be an internal marsupium. A front view shows a long central hornlike leaf about three-fourths the length of the entire gonangium, and two very broad flattened leaves, with upper edges with five or six irregular and somewhat jagged projections or teeth to each leaf. Focusing lower, one can see on the opposite side a thick hornlike process which probably represents a leaf, and another similar one curving in the opposite direction, the two seeming to embrace the marsupium. In a side view the gonangia appear much more slender showing an anterior long slender horn, a posterior short stouter and more curved one, and lateral leaves, one on each side with their jagged edges. These are much narrower in this point of view.

Localities.—Dredging station 5310, China Sea, vicinity of Hongkong, 21° 33′ N., 116° 13′ E. Station 5311, China Sea, vicinity of Hongkong, 21° 33′ N., 116° 15′ E.; depth, 88 fathoms.

Distribution.—The type was presumably from the eastern coast of South Africa.

DIPHASIA INORNATA, new species

Plate 43, fig. 1

Trophosome.—Colony pinnate, stem simple, total height 7½ cm., spread 3½ cm. Stem divided into irregular internodes, almost straight, although very slightly flexuose with a tendency to bearing two branches to each internode. Proximal 1 cm. without hydrothecae. The branched portion bears one hydrotheca above, one below and one opposite each branch. Branches alternate, constricted at their origins, each borne on a distinct shoulderlike process of the stem and separated from it by a deeply incised node. Hydrothecae strictly alternate, usually about six to each internode, immersed for about three-fourths their entire length. Distal portion abruptly constricted and bending outward from the flask-shaped body. Margin pitcher shaped and bearing a single adcauline operculum, as is characteristic of the genus. The hydranths are not sufficiently well preserved for description.

Gonosome.—Gonangia borne on upper side of branches, small for this genus, oblong-ovate in shape and without the spines characteristic of *Diphasia*. There are indications of an internal marsupium which in some instances seems to have broken out of the aperture and formed a sort of an acrocyst. The indications are that these gonangia bear male reproductive elements.

Locality.—Dredging station 5325, off northern Luzon, Hermanos Island, 18° 34′ 15″ N., 121° 51′ 15″ E.; depth, 224 fathoms.

Holotype.—Cat. No. 42178, U.S.N.M.

This species comes nearest to *Diphasia kincaidi* (Nutting),[18] from which it differs in having strictly alternate instead of subopposite hydrothecae, which are less robust than in the former species. The gonangia are a good deal the same in the two, except that those of *D. kincaidi* have no internal marsupium.

The present writer has always stood for a statute of limitations for zoological names, and therefore does not follow Stechow,[19] who regards *Diphasia* of Agassiz as a synonym of *Nigellastrum* of Oken, 1815.

PASYTHEA QUADRIDENTATA (Ellis and Solander)

Sertularia quadridentata Ellis and Solander, Nat. H. Zooph., 1786, p. 57.

Pasythea quadridentata Esper, Die Pflanzenthiere in Abbildungen, vol. 3, 1788, p. 237.

Pasythea, species, Inaba, Hydroida of the West Coast, Kishu, 1892, figs. 11–14.

Pasythea nodosa Hargitt, Notes on a few Coelenterates of Wood's Hole (Contr. Zool. Lab. Syracuse Univ.) 1908, pp. 114–117.

Pasythea quadridentata Fraser, Some Hydroids of Beaufort, N. C., 1912, p. 372.

I have no doubt that Fraser was right in his decision that Hargitt's *P. nodosa* is the same as the original *Pasythea quadridentata*, as proved by the finding of the gonangia.

In the specimen secured by the *Albatross* in 1907 the gonangia are also present and exactly like those figured by me in American Hydroids (pt. 2, pl. 13, fig. 5).

---

[18] *Thuiaria elegans* Nutting, Hydroids of the Harriman Alaska Expedition, 1901, p. 187. *Diphasia kincaidi* Nutting, Hydroids from Alaska and Puget Sound, 1899, p. 743.

[19] Hydroidenfauna des Mittelmeeres, Amerikas u. s. w., 1923, p. 160.

Locality.—Dredging station 5559, Jolo Island and vicinity, Cabalian Point, 5° 51′ 36″ N., 121° 0′ 45″ E. Surface, on floating *Sargassum.*

Distribution.—Almost world-wide except in the polar regions, in tropical, subtropical, and temperate zones.

This interesting species on account of its habitat on floating seaweed has been very widely distributed and thus has come to vary greatly. I strongly suspect that there is only one species of the genus and that the forms such as *P. philippina* of Marktanner-Turneretscher and *P. griffini* of Hargitt will eventually be relegated to the list of synonyms.

Family SYNTHECIDAE

SYNTHECIUM TUBITHECUM (Allman)

Sertularia tubitheca ALLMAN, Memoirs Museum Comparative Zoölogy, vol. 5, No. 2, 1877, p. 24.

Synthecium tubithecum NUTTING, American Hydroids, pt. 2, 1904, p. 134.

This well-known and graceful species was dredged by the *Albatross* at station 5311, China Sea, vicinity of Hongkong, 21° 33′ N., 116° 15′ E.; depth, 88 fathoms.

The gonosome is present and is very much like that of the type examined by me in the Museum of Comparative Zoology at Cambridge,[20] being very closely and deeply annulated throughout and with a narrow neck and everted margin much like many gonangia found in the Sertularidae, especially in the genus *Sertularella.*

Distribution.—West Indies (Allman), Amboina and Ternate Molucca (Pictet and Campenhausen), Hawaii (Nutting), Japan (Stechow).

This appears to be the first report of its occurrence in the Philippines, unless, as I suspect, Hargitt's *Synthecium flabellum*[21] is a synonym for *S. tubithecum.* It agrees quite closely, so far as the trophosome is concerned, and his drawings of the gonangia show no details by which his species can be differentiated from *S. tubithecum.*

Family PLUMULARIDAE

PLUMULARIA BUSKII Bale

Plumularia buskii BALE, Australian Hydroid Zoophytes, 1884, p. 125, pl. 10, fig. 3; pl. 19, figs. 34–35.

Trophosome.—Colony pinnate, 3 cm. high and with a spread of 1 cm. Stem not fascicled, with some irregular annulations at the basal end, no evident nodes except at the extreme distal end where there are a few oblique nodes resembling those on the hydrocladia.

---

[20] American Hydroids, pt. 2, The Sertularidae, 1904, p. 134.

[21] Hydroids of the Philippine Islands, 1924, p. 497.

The stem bears a hydrotheca on its front near the base of each hydrocladium. Hydrocladia alternate, borne on the front of the stem rather than on its sides, each with a strongly marked node a short distance from the stem; but there are no evident internodes except near the ends of the hydrocladia borne on the distal part of the stem. Here they are oblique and there is a tendency toward a hydrotheca to each internode. In one or two places intermediate internodes are seen, but this is quite exceptional. Hydrothecae short cylinders in shape, resembling drums, the distal half of the adcauline side being free, slightly expanded near the margin which is even and round. Nematophores—below the base of each hydrotheca is a nematophore that greatly resembles those of the statoplean plumularians, being sessile and apparently adherent to the lower part of the hydrotheca. There are usually two other mesial nematophores between successive hydrothecae which are on short pedicels and movable. A pair of supracalycine nematophores arise from the point where the distal part of the hydrotheca becomes free, but do not rise to the level of its margin. Their distal part is bell-shaped and the margin somewhat flaring. There are also irregularly placed nematophores on the stem.

Gonosome.—Gonangium oblong ovate, round in section, aperture oblique, borne on a short pedicel growing from a hydrocladium at the base of a hydrotheca. There is a single large nematophore on the proximal part of the gonangium near the pedicel. The gonangia have a slightly thickened rim around the aperture and the contents indicate that the colony is male.

Locality.—Davao Bay, from pearl oyster, several specimens secured.

Distribution.—Griffiths Point, Australia (Bale).

PLUMULARIA AGLAOPHENOIDES Bale

Plate 43, figs. 2, 3

Plumularia aglaophenoides Bale, Australian Hydroid Zoophytes, 1884, p. 126, pl. 10, fig. 6.

The specimens secured by the *Albatross* agree quite closely with the description and figures by Bale, which are so satisfactory that nothing need be added so far as the trophosome is concerned.

The fragments before me do not show the fascicled stem as described by Bale, but they may be branches rather than parts of the main stem.

Gonosome.—Heretofore unknown. Gonangia borne on the hydrocladia, in the shape of heavy curved clubs. Smaller than in the last species and about twice the height of the hydrothecae. No nematophores are seen at the bases of the gonangia.

Locality.—Dredging station 5151, Sulu Archipelago, Tawi Tawi group, Sirun Island, 5° 24′ 40″ N., 120° 27′ 15″ E.; depth, 24 fathoms.

Distribution.—Broughton Island, Australia, 25 fathoms. This seems to be the first report of the occurrence of this species in the Philippine region.

PLUMULARIA FLABELLATA, new species

Plate 43, figs. 4, 5

Trophosome.—Colony strictly flabellate in form, 8.7 cm. high and with a spread of 9.5 cm. Color dark brown after long immersion in alcohol. Stem, primary branches and secondary branches fascicled. The branches and branchlets subopposite. Hydrocladia borne on main stem, primary and secondary branches, opposite and springing from the sides rather than the front of the stem or branch and more closely approximated than is usual in this genus. Indeed, the general facies of the colony would lead one to regard it as belonging to the Statoplea rather than to the Eleutheroplea were the nematophores not free or movable. Hydrocladia divided by oblique nodes into regular internodes, each of which bears a hydrotheca. Hydrothecae quite small, rather closely approximated, deep, pitcher-shaped with a margin devoid of teeth, everted in front and with the sides beveled off behind where they join the hydrocladium. The internode behind the hydrotheca is dense and shows internal thickenings of chitin opposite the mesial nematophore and below the process bearing the supracalycine nematophore just below the node between the adjacent hydrothecae. Nematophores very minute, movable, fragile, often lacking. The supracalycine pair are borne on slight processes below the top of the hydrotheca and often hang down into the hydrothecal cavity, this being rendered possible by the beveling of the hydrothecal margin behind. The mesial nematophore is borne on a relatively short process below the hydrotheca. There are often two cauline nematophores below the proximal hydrotheca on each hydrocladium.

Gonosome.—Not present.

Locality.—The holotype, Cat. No. 42179, U.S.N.M., is from Davao Bay, growing on a pearl oyster. Station 5254, Gulf of Davao, Linao Point, 7° 5′ 42″ N., 125° 39′ 42″ E.; depth, 21 fathoms. The hydrothecae of this fine species very closely resemble those of *P. dendritica* Nutting,[22] but it differs widely from that species in the form of colony, manner of branching, color, and character of the hydrocladial internodes.

---

[22] American Hydroids, pt. 1, the Plumularidae, 1900, p. 67, pl. 8, figs. 4–6.

PLUMULARIA HARGITTI, new species

Plate 44, figs. 1, 2

Trophosome.—Colony 4½ cm. high and with a spread of 1 cm., main stem not fascicled, straight with irregularly disposed straight nodes and bearing neither hydrothecae nor nematophores. Hydrocladia alternate and closely approximated, borne on distinct shoulders of the stem and projecting from the stem at an angle of about 45°, divided into alternating hydrothecate and intermediate internodes which are divided by alternating straight and oblique nodes, the latter being just below the hydrothecae and the former just opposite the tops of the hydrothecae. Hydrothecae large for this group, rather deep, cup-shaped, with slightly everted margins, one and one-half times as deep as wide, and separated by a distance of about one and one-half times their height. Nematophores small, the supracalycine pair being inserted on the hydrocladium some distance below the free distal part of the hydrotheca and not attaining to the level of the point where the latter separates from the branch. There are usually two, rarely three, mesial nematophores between the adjacent hydrothecae. The one immediately below each hydrotheca is somewhat stouter than the others.

Gonosome.—Gonangia large, elongated saclike structures with rounded distal ends, about six times the height of the hydrothecae and with a short pedicel. There are two to four nematophores borne on the gonangium just above the pedicel.

Locality.—Dredging station 5174, vicinity of Jolo, Jolo Light, 6° 3′ 45″ N., 120° 57′ E.; depth, 20 fathoms.

Holotype.—Cat. No. 42180, U.S.N.M.

This species is named in honor of my friend, Dr. Charles W. Hargitt, of Syracuse University, who has done much valuable morphological and experimental work on the hydroids. It evidently belongs to the *catharina* group but differs from that species in having alternate and more nearly approximated hydrocladia and hydrothecae and in shape and size of gonangia. It differs from *P. aglaophenoides* Bale in having a fascicled stem and in several other details.

PLUMULARIA DENDRITICA Nutting

Plumularia dendritica, Nutting, American Hydroids, pt. 1, p. 67, pl. 8, figs. 4–6.

The specimens dredged by the *Albatross* during her Philippine cruise agree very exactly with the original descriptions and figures, and a comparison with the type specimen in the museum of the State University of Iowa confirms this view.

Localities.—Dredging station 5163, Sulu Archipelago, Tawi Tawi group, Observation Island, 4° 59′ 10″ N., 119° 51′ E.; depth, 28 fathoms. China Sea, vicinity of Formosa, Ibugos Island, 20° 19′ 30″ N., 121° 51′ 15″ E.; depth, 26 fathoms.

Distribution.—The type and until now the only known specimen was from near Little Cat Island, Bahamas, from shallow water.

The specimens secured of this species were rather fragmentary, and, of course, much smaller than the type which was one of the largest plumularian hydroids that the writer has ever seen.

PLUMULARIA CAMARATA, new species

Plate 44, figs. 3, 4

Trophosome.—Colony flabellate in form, 12 cm. high, and with a spread of 4 cm. Stem, branches, and branchlets fascicled, very dark in color, the branches springing irregularly from the opposite sides of the stem and the branchlets similarly related to the branches. Hydrocladia borne on the stem, branches, and branchlets alternate on opposite sides of the branches from which they spring; not regularly divided into internodes, the nodes being far apart, oblique, and most apparent near the proximal end of the hydrocladia. These latter have their interior divided by very strongly marked internal ridges, there being usually four behind each hydrotheca suggesting a division of the hydrocladia into a number of chambers; hence the name "*camarata.*" These ridges are strongest on the proximal and weakest on the distal parts of the hydrocladia.

Hydrothecae very deep, tubular, three times as high as wide, and of approximately equal diameter throughout most of their length. Margin without teeth of any kind but sharply beveled on its adcauline side where it joins the hydrocladium at a very acute angle. The hydrothecae are very closely approximated so that the top of one reaches almost to the base of the one next above it. Nematophores, supracalycine pair small, with hardly any evident supporting brackets, arising from the hydrocladium at the point where it is joined by the greatly beveled hydrothecal margin, their distal ends slightly if at all, overtopping the highest (abcauline) part of the hydrothecal margin. Often these nematophores appear to topple over into the hydrothecal cavity. Mesial nematophores rarely present in the specimen described, but they are occasionally seen on the proximal part of the hydrocladia where they are borne on short, rounded prominences just below the hydrothecal bases. Cauline nematophores are found, often in pairs, on the stem and branches near the axils of the hydrocladia. All nematophores are bithalamic and free.

Gonosome.—Not present.

Locality.—Dredging station 5165, Sulu Archipelago, Tawi Tawi group, Observation Island, 4° 58′ 20″ N., 119° 50′ 30″ E.; depth, 9 fathoms.

Holotype.—Cat. No. 42181, U.S.N.M.

This species is evidently nearest *P. dendritica* Nutting,[23] which it resembles greatly in the form of the hydrothecae and in general appearance. It differs, however, in having much more distant hydrothecae, in the absence of regular hydrocladial internodes and in the very strong internal ridges in the hydrocladia. Although the two species are found in the same general region, the specimens differ constantly in the points just mentioned and the writer feels that they should be regarded as distinct species. Indeed, they are fully as distinct as many other species of *Plumularia* and *Aglaophenia* which have been recognized. This species also resembles *Plumularia asymmetrica* Bale [24] particularly in the general shape of hydrothecae, the internal hydrocladial ridges and the nematophores. It differs materially in not having the anterior intrathecal ridge and in not having the two sides of the hydrothecae unsymmetrical as described by Bale.

ANTENNELLA BIARMATA, new species

Plate 44, fig. 5

Trophosome.—Colony consisting of a number of upright hydrocladia springing directly from a creeping root-stalk and attaining a height of about 3 cm. Proximal part of hydrocladia devoid of hydrothecae but often bearing a double row of nematophores on one side, there being sometimes as many as 16 pairs of nematophores below the first hydrotheca. Nodes oblique, not regularly disposed, but with a tendency to showing two hydrothecae to each internode. Often there is a very pronounced oblique node about the middle of the hydrocladium. Hydrothecae stiffer and more dense than in other species of this genus that I have seen, closely approximated, being separated by less than their own height, cylindrical, deeper than most of the genus, one and one-half times as deep as wide; margin even, distinctly everted so that the actual aperture is much greater than a section below the margin. About one-fifth of the distal part of the hydrotheca is free from the hydrocladium which bears it. Nematophores—there are two pairs of supracalycine nematophores, one borne on a long rodlike support springing from the hydrocladium almost opposite the middle of the hydrotheca and extending outward and a little upward nearer to the hydrothecal margin, so that the nematophore itself projects beyond the front of the hydrotheca but considerably below the aperture. Immediately above the bases of these supports is another pair of nematophores which are practically sessile on the hydrocladium. Between these and the bottom of the next hydrotheca above are usually two and occasionally three pairs of cauline nematophores, thus making four or five pairs of nematophores to each hydrotheca. The nematophores are all two-chambered after the usual eleutheroplean type.

---

[23] American Hydroids, pt. 1, 1900, p. 67, pl. 8, figs. 4–6.

[24] Report on the Hydroids collected in the Great Australian Bight, etc., 1914, p. 29, pl. 4, figs. 2 and 3.

Gonosome.—Not present.

Locality.—Davao Bay, borne on pearl-oyster shells, depth not given.

Holotype.—Cat. No. 42182, U.S.N.M.

This very remarkable species may eventually require a new genus for its reception, but the writer desires to avoid the establishing of new genera whenever practicable, especially where the gonosome is not known.

ANTENNELLA RECTA, new species

Plate 44, figs. 6, 7

Trophosome.—Colony consisting of hydrocladia springing directly from a creeping root-stalk, 16 mm. in height. Hydrocladia divided very obscurely into internodes, each of which bears a hydrotheca. Nodes not oblique but at right angles to the axis of the hydrocladium. Occasionally there is an oblique node just below the proximal hydrotheca. Hydrothecae separated by twice their height, bell-shaped with margins slightly flaring, height equal to the diameter of the aperture. Nematophores—supracalycine pair borne on processes from the hydrocladium nearly opposite the aperture of the hydrothecae and considerably overtopping the latter. There is a mesial nematophore just at the base of the hydrotheca and one or two others between this and the next hydrotheca below.

Gonosome.—Not known.

Locality.—Dredging station 5310, China Sea, vicinity of Hongkong, 21° 33′ N., 116° 13′ E.; depth, 100 fathoms.

Holotype.—Cat. No. 42188, U.S.N.M.

This species differs from all others of the genus except *P. microscopica* (Mulder and Trebilcock)[25] in having no intermediate internodes and nodes straight and not oblique.

According to the figure given by the authors the hydrotheca of *P. microscopica* is tubular and more than twice as deep as broad.

NEMERTESIA CYLINDRICA (Bale)

Antennularia cylindrica BALE, Australian Hydroid Zoophytes, 1884, p. 146, pl. 10, fig. 7.

The specimens collected by the *Albatross* agree very well with the description and figures given by Bale. In the former, however, the mesial nematophores are absent except those immediately below each proximal hydrotheca on the hydrocladium. The gonosome is unknown.

---

[25] Geelong Naturalist, vol. 4, ser. 2, 1909 (pages not numbered in reprint), pl. 1, fig. 4.

Locality.—Dredging station 5596, off Zamboanga, Mindanao, 6° 54′ N., 122° 4′ 30″ E.; depth, 9 fathoms.

Distribution.—Port Curtis, Australia (Bale).

As Bale says, this species resembles *Plumularia cylindrica* Kirchenpauer. It differs greatly, however, in the character of the supracalycine nematophores, a character not well brought out by Bale. Those in *Nemertesia cylindrica* are very broad and stout, almost sessile with a very conspicuous bay or sinus in the margin.

ANTENNOPSIS PACIFICA, new species

Plate 45, figs. 3, 4

Trophosome.—Colony 10 cm. long and with a spread of 2 cm. Main stem not canaliculated nor fascicled, flexuose, dark brown in color; nodes almost all oblique, deeply incised, irregular in distribution. Branches much like the stem, scattered, occasionally bifurcating, divided irregularly into internodes by oblique nodes, but tending to bear two hydrocladia on each internode. Hydrocladia all springing from the upper side of the branch, but inclined alternately to the right and left, divided into regular internodes, each of which bears a hydrotheca on its proximal part. No intermediate internodes. Hydrothecae small, conical in shape, margins smooth everted, borne on thick shoulders of the hydrocladia, rather closely approximated, being separated by about twice their height, although sometimes considerably more distant. All, however, are more closely approximated than other species of this genus that I have known. Nematophores relatively very large, often about as high as the hydrothecae, bithalamic, with the distal chamber flaring, conical in outline. Supracalycine pair inserted almost on a level with the top of the hydrotheca and rising above it a distance almost equal to that of the height of the latter. A mesial nematophore is inserted on the shoulder immediately below each hydrotheca, and these are the largest of the nematophores. Two others are usually placed between the mesial one and the next hydrotheca below, while there are few nematophores on the stem or branches.

Gonosome.—Not present.

Locality.—Dredging station 5148, Sulu Archipelago, vicinity of Sirun Island, 5° 35′ 40″ N., 120° 47′ 30″ E.; depth, 17 fathoms.

Holotype.—Cat. No. 42183, U.S.N.M.

So far as the writer knows, this very distinct species is the first of the genus *Antennopsis* recorded from the Pacific Ocean. The shape of the hydrothecae, their approximation, and the relatively great size of the nematophores are characteristic of the species.

ACANTHELLA EFFUSA (Busk)

Plate 45, figs. 1, 2

Plumularia effusa BUSK, Voyage of the *Rattlesnake*, 1852, vol. 1, p. 400.
Plumularia effusa KIRCHENPAUER, Ueber die Hydroidenfamilie, Plumularidae, pt. 2, 1876, p. 46, pl. 1, fig. 4.
Acanthella effusa ALLMAN, Hydroids of the Challenger, pt. 1, 1883, p. 27, pl. 6.

This remarkable species is represented by several fine specimens in the collection under consideration, and fortunately the gonosome, hitherto unknown, is included. Allman's description is accurate and fairly complete, but the following items may be added:

Trophosome.—Stem and main branches not fascicled, the lower part of the former not bearing hydrocladia but beset with four regular rows of stubby, thornlike processes which bear nematophores, often in pairs, and are of the usual eleutheroplean type. (Allman represents these as sharp thorns in his figure.) The stem is also divided into regular internodes. The distal branchlets bear thornlike processes as described by Allman. The hydrocladia are quite dense, divided into regular internodes, each bearing a hydrotheca. Hydrocladial internodes with usually three strong internal thickenings back of the hydrotheca. Hydrotheca typically pitcher-shaped as described by Allman.

Gonosome.—(Hitherto unknown.) Gonangia borne on branches at bases of hydrocladia where they form a double row on one side of the branch. They are small, triangular in outline, shaped like flattened cones. They are not protected by specialized branches in the form of phylactogonia.

Localities.—Dredging station 5139, vicinity of Jolo, Jolo Light, 6° 6′ N., 120° 2′ 30″ E.; depth, 20 fathoms. Station 5141, vicinity of Jolo, Jolo Light, 6° 9′ N., 120° 58′ E.; depth, 29 fathoms. Station 5146, Sulu Archipelago, vicinity of Sulade Island, 5° 46′ 40″ N., 120° 48′ 50″ E.; depth, 24 fathoms. Station 5149, Sulu Archipelago, vicinity of Sirun Island, 5° 33′ N., 120° 42′ 10″ E.; depth, 10 fathoms. Station 5174, vicinity of Jolo, Jolo Light, 6° 3′ 45″ N., 120° 57′ E.; depth, 20 fathoms. Station 5484, between Samar and Leyte, vicinity of Surigao Strait, Cabugan Grande Island, 10° 28′ N., 125° 20″ E.; depth, 76 fathoms. Station 5557, Jolo Island and vicinity, Cabalian Point, 5° 51′ 30″ N., 121° 1′ E.; depth, 13 fathoms.

Distribution.—Torres Strait (Busk), Philippines (Kirchenpauer), reefs off Zamboanga (Allman).

This is one of the most striking species of plumularians that the writer has ever seen, and the graceful, pitcher-shaped hydrothecae are unique in form. So far as I know, this species has not been seen since the *Challenger* expedition secured it and Allman reported on it in 1883.

STECHOWIA, new genus

Branches scattered over the hydrocaulus and bearing hydrocladia, each of which bears a single hydrotheca beyond which the hydrocladium is produced into a long, slender process bearing nematophores. This genus combines the scattered branches of *Antennopsis* and the hydrocladia bearing a single hydrotheca, as in the genus *Monotheca.* The unique character, however, is the extension of the hydrocladium far beyond the hydrotheca as a free nematophorous process.

I take pleasure in naming this very distinct genus after my friend, Dr. E. Stechow, of Munich, an outstanding authority on the Hydroida.

Genotype.—Stechowia armata, new species.

STECHOWIA ARMATA, new species

Plate 46, figs. 1, 2

Trophosome.—Colony 1½ cm. in height and 8 mm. in spread; main stem unfascicled, straight, not definitely divided into internodes; branches alternate on basal part and scattered over the distal portion, divided into regular internodes, each of which bears a hydrocladium and irregularly distributed nematophores. Hydrocladia alternate, borne on shoulders from the distal end of each internode of the branch and bearing a single hydrotheca, beyond which the hydrocladium is produced into a slender, tendril-like process which is divided into irregular internodes, each of which, as a rule, bears a single nematophore. These extensions of the hydrocladia are often several times the length of the hydrotheca. Hydrothecae bell shaped with flattened margin, wider than deep, borne on the second internode of each hydrocladium. Nematophores, a supracalycine pair inserted distinctly above each hydrotheca, a mesial one distinctly below the case of each hydrotheca, and a cauline nematophore on the proximal nonhydrothecate internode of each hydrocladium. There is also a nematophore on each joint of the process extending beyond each hydrotheca and often a pair at the distal end of this process. Cauline nematophores are also found in the axil of each hydrocladium, one on each internode of the branches which bear the hydrocladia, and a number scattered over the main stem.

Gonosome.—Gonangia borne on the proximal parts of the branches, oblong-ovate in form, with their distal ends abruptly truncated. The contents indicate that the colony described is male.

This species bears a superficial resemblance to *Calvinia mirabilis* Nutting,[26] in which the mesial nematophore of each hydrotheca is produced into a nematophorous branch somewhat resembling the one described above. In that species, however, there are a number of hydrothecae borne on each hydrocladium, and the nematophorous branch replaces a greatly modified mesial nematophore, while in the present species the nematophorous branch is a continuation of the hydrocladium itself.

---

[26] American Hydroids, pt. 1, The Plumularidae, 1900, p. 77.

Type locality.—Davao Bay, Gulf of Davao, growing on a pearl oyster, May 18, 1908.

Holotype.—Cat. No. 42184, U.S.N.M.

As this hydroid was found on a pearl oyster shell, it came from relatively shallow water, probably from a depth not greater than 25 fathoms.

AGLAOPHENIA MACGILLIVRAYI (Busk)

Plumularia macgillivrayi BUSK, Voyage of the *Rattlesnake*, 1852, vol. 1, p. 400.

Aglaophenia macgillivrayi KIRCHENPAUER, Ueber die Hydroidenfamilie Plumularidae, 1872, p. 27.

(?) *Aglaophenia cupressina* LAMOUROUX, Histoire des Polypiers Coralligènes, 1816, p. 169.

Allman [27] has given such a complete description and excellent figures of this species that further treatment seems unnecessary. The great size of the mesial nematophores and the small size of the hydrothecae as compared with the thickness of the hydrocladia are characteristic features. The gonosome was a corbula entirely in conformity with the true *Aglaophenia* type.

Localities.—From Nogas Point, Panay, beach. Dredging station 5321, China Sea, vicinity of Formosa, Ibugos Island, 20° 19′ 30″ N., 121° 51′ 15″ E.; depth, 26 fathoms. Dredging station 5559, Jolo Island and vicinity at Cabalian Point, 5° 51′ 36″ N., 121° 0′ 45″ E.; depth 13 fathoms. Tonquil Island, Gumila Reef, depth not given. Sabtan Island, November 8, 1908. Cataingan Bay, Dumurug Point, April 18, 1908.

Distribution.—Louisiade Archipelago, Australia (Busk); Simons Bay, Cape of Good Hope (Allman); near Mindanao, Philippines (Hargitt).

This remarkable form has very large nematophores and nematocysts which can be seen in the specimens secured, their threads extending in bundles from the apertures of the nematophores.

AGLAOPHENIA CALYCIFERA Bale

Aglaophenia calycifera BALE, Report on the Hydroids collected in the Great Australian Bight, etc., pt. 2, 1914, p. 178, pl. 37, figs. 3 and 4.

A fragmentary specimen is referred with some doubt to this form. The gonosome is absent.

---

[27] Challenger Reports, The Hydroids, pt. 1, 1883, p. 34, pls. 10 and 20, figs. 4–6.

Locality.—Dredging station 5132, Sulu Sea, off western Mindanao, island off Panabutan Point, N. 15° W., 0.30 mile; depth, 26 fathoms.

Distribution.—Great Australian Bight (Bale), longitude 130° 41′ E.; 160 fathoms; longitude 126° 45½′ E.: 190–320 fathoms.

AGLAOPHENIA URENS Kirchenpauer

Aglaophenia urens KIRCHENPAUER, Ueber die Hydroidenfamilie Plumularidae, 1872, p. 46, pl. 1, fig. 27.

The specimens secured by the *Albatross* on her Philippine cruise agree quite closely with the description and figures given by Kirchenpauer, and I have no doubt regarding the identity of the form.

Locality.—Dredging station 5157, Sulu Archipelago, Tawi Tawi group, Tinakta Island, 5° 12′ 30″ N., 119° 55′ 50″ E.; depth, 18 fathoms.

Distribution.—Java and Singapore (Kirchenpauer); Australia, Port Stephens and Port Denison (Haswell, according to Bale). This very well marked species has not hitherto been reported from the Philippine region.

AGLAOPHENIA DIVARICATA (Busk)

Plumularia divaricata BUSK, Voyage of Rattlesnake, 1852, vol. 1, p. 398.

Aglaophenia ramosa KIRCHENPAUER (not Busk). Ueber die Hydroidenfamilie Plumularidae, 1872, p. 38, pls. 1 and 2, fig. 17.

Aglaophenia divaricata BALE, Australian Hydroid Zoophytes, 1884, p. 162, pl. 15, figs. 7 and 8.

(?) *Aglaophenia mccoyi* BALE, Journ. Microscop. Soc. Victoria, 1881, p. 24.

The specimens before me agree very closely with the descriptions and figures of this species given by Bale. In habit of growth, however, there is very wide divergence, our specimens consisting of a number of slender, unbranched, upright stems, all apparently growing from a common creeping root stalk. In the absence of the gonosome, the present writer does not feel justified in separating this form under a new name.

Locality.—Dredging station 5248, Gulf of Davao, Lanang Point, 7° 7′ 25″ N., 125° 40′ 24″ E.; depth, 18 fathoms.

Distribution.—Bass Strait (Busk), several Australian localities, i. e., Brighton, Wilsons Promontory, Port Jackson, Queens Cliff, Williamstown (Bale), also Georgetown (Tasmania).

AGLAOPHENIA TRIRAMOSA, new species

Plate 46, figs. 3, 4

Trophosome.—Colony plumosely branched, 16 cm. high and with a spread of about 6 cm. Main stem fascicled, main branches all on one side and each branch again branching into three branchlets which bear the hydrocladia. (Hence the name *triramosa.*) The main stem also bears hydrocladia, but has no evident nodes. Branches fascicled basally, simple distally, and without evident internodes. Hydrocladia springing from one side of the branchlets, alternate, growing at a rather sharp angle from the branchlet; divided into regular internodes each bearing a hydrotheca. Hydrothecae separated by about one-fifth of their height, deep, subcylindrical, margin somewhat everted and without teeth except a small but evident one in front. The lateral parts of the margin are undulatory, but without definite teeth. There is a small chitinous interior strap in each internode below the supracalycine nematophores and another near the bottom of each hydrotheca. Nematophores—supracalycine nematophores rather large, their openings rising above the top of the hydrotheca and their margins cut away on the adcauline side. Mesial nematophores are stout and their margins do not quite attain the height of the middle of the hydrotheca. Their outer profile is quite straight. Cauline nematophores in a row on the main stem opposite the side from which the branches spring, there is also a row of hydrothecae scattered among these nematophores.

Gonosome.—Gonangia borne in closed corbulae which are modified hydrocladia borne on the branchlets. They are about 8 mm. long and 1½ mm. in width, tapering gradually distally, composed of about 16 pairs of corbula leaves, most of which meet above although the distal ones do not. There are no hydrothecae at the bases of the corbula leaves, but there is a large nematophore at each leaf base. The rest of the nematophores are very minute and inconspicuous, there being a row of six or eight on the edge of each leaf. There are usually two or three hydrothecae on the hydrocladium between the corbula and branch from which it arises.

Localities.—Dredging station 5310, China Sea, vicinity of Hongkong, 21° 33′ N., 116° 13′ E.; depth, 100 fathoms. Station 5311, China Sea, vicinity of Hongkong, 21° 33′ N., 116° 15′ E.; depth, 88 fathoms. Station 5312, China Sea, vicinity of Hongkong, 21° 30′ N., 116° 32′ E.; depth, 140 fathoms.

The peculiar manner of branching and the extremely minute nematophores on the corbulae are good diagnostic features of this species,

Holotype.—Cat. No. 42189, U. S. N. M.

LYTOCARPUS PHOENICEUS (Busk)

Plumularia phoenicea BUSK, Voyage of the Rattlesnake, 1852, vol. 1, p. 398.

Aglaophenia phoeniceus BALE, Australian Hydroid Zoophytes, 1884, p. 159, pl. 17, figs. 1–4; pl. 19, fig. 31.

Lytocarpus phoeniceus BALE, The Genera of the Plumularidae, etc., 1887, p. 15.

The specimens collected on the Philippine cruise of the *Albatross* agree very exactly with the detailed description and excellent figures given by Bale in his Australian Hydroid Zoophytes, both as to the trophosome and gonosome, excepting that the hydrothecal margins are more strongly dentate than is represented by him; but occasional hydrothecae have teeth reduced to the extent represented in some of Bale's figures.

The gonosome is almost identical with that of *Lytocarpus hawaiensis* Nutting.[28] But the hydrothecae are quite different in form.

Localities.—Dredging station 5249, Gulf of Davao, Lanang Point, 7° 6′ 6″ N., 125° 40′ 8″ E.; depth, 23 fathoms. Station 5321, China Sea, vicinity of Formosa, Ibugos Island, 20° 19′ 30″ N., 121° 51′ 15″ E.; depth, 26 fathoms. Station 5642, Buton Straits, Tikola Peninsula, 4° 31′ 40″ S., 122° 49′ 42″ E.; depth, 37 fathoms.

The specimen from station 5249 has hydrothecae which agree quite exactly with the figures given by Bale; therefore the species appears to be correctly identified.

Distribution.—Australia, Prince of Wales Channel (Busk); various Australian points (Bale); Singapore (Kirchenpauer); Amoy Island (Swoboda); Japan (Arrotz); Indian Ocean (Swoboda); Sagami Sea, Japan (Inaba); Hawaiian Islands (Nutting).

LYTOCARPUS SPECTABILIS Allman

Lytocarpus spectabilis ALLMAN, Report on Hydroida of the Challenger Expedition, pt. 1, 1883, p. 43, pl. 15.

The trophosome only is found in our specimens, but it agrees quite exactly with Allman's description and figures.

Locality.—Dredging station 5150, Sulu Archipelago, vicinity of Siasi, Sirun Island, 5° 23′ 20″ N., 120° 35′ 45″ E.; depth, 21 fathoms.

Distribution.—The types were taken by the *Challenger* from Zamboanga, Philippines, and Torres Strait (Allman). So far as I know, this species has not been reported since its original discovery by Allman.

LYTOCARPUS PENNARIUS (Linnaeus)

Sertularia pennaria LINNAEUS, Systema Natura, 1758, p. 813.

Lytocarpus secundus ALLMAN, Challenger Reports, the Hydroids, Part 1, The Plumularidae, 1883, p. 42.

Aglaophenia (*Lytocarpia*) *secunda* KIRCHENPAUER, Ueber die Hydroidenfamilie Plumularidae, 1872, p. 35.

Lytocarpus hawaiensis NUTTING, Hydroids of the Hawaiian Islands, 1905, p. 954.

Lytocarpus pennarius RITCHIE, Hydroids of the Indian Museum, 1910, p. 19.

This appears to be an exceedingly variable species, particularly in the shape of the hydrothecae. In the specimen at hand, individual hydrothecae can be found to match the drawings of this form made by Kirchenpauer, Allman, Ritchie, and the present writer. It therefore seems proper to adopt the opinion of Ritchie and regard the species of Linnaeus, Kirchenpauer, Allman, and Ritchie as identical, and to these should be added my own *L. hawaiensis* with the type of which I have compared the specimen under consideration. All of these show a gonosome of peculiar type consisting of curved phylactogonia, beset with a double row of opposite nematophores. The gonangia are ovoid sacs borne at the bases of the phylactogonia.

---

[28] Hydroids of the Hawaiian Islands, 1905, p. 945, pl. 12, fig. 12.

Localities.—Dredging station 5146, Sulu Archipelago, vicinity of Siasi, Sulade Island, 5° 46′ 40″ N., 120° 48′ 50″ E.; depth, 24 fathoms. Station 5302, China Sea, vicinity of Hongkong, 21° 42′ N., 114° 50′ E.; depth, 38 fathoms. Station 5303, China Sea, vicinity of Hongkong, 21° 44′ N., 114° 48′ E.; depth, 34 fathoms. Station 5304, China Sea, vicinity of Hongkong, 21° 46′ N., 114° 47′ E.; depth, 34 fathoms. Station 5305, China Sea, vicinity of Hongkong, 21° 54′ N., 114° 46′ E.; depth, 37 fathoms. Station 5332, Mindoro Strait, at Apo Light, 12° 47′ 15″ N., 120° 41′ E.; depth, 745 fathoms. Station 5338, Palawan Passage, Observatory Island, 11° 33′ 45″ N., 119° 24′ 45″ E.; depth, 43 fathoms. Station 5342, Malampaya Sound, Palawan Island, Endeavor Point, 10° 56′ 55″ N., 119° 17′ 24″ E.; depth, 14 to 25 fathoms. Station 5355, North Balabac Strait, at Balabac Light, 8° 8′ 10″ N., 117° 19′ 15″ E.; depth, 44 fathoms. Station 5358, Jolo Sea, Sandakan Light, 6° 6′ 40″ N., 118° 18′ 15″ E.; depth, 39 fathoms. Station 5399, North of Cebu, Tanguingui Island, 11° 21′ 45″ N., 124° 5′ E.; depth, 32 fathoms. Station 5432, Eastern Palawan and vicinity, Corandagos Island, 10° 37′ 50″ N., 120° 12′ E.; depth, 51 fathoms.

Distribution.—Hawaiian Islands (Nutting); South Sea, China and Pelew Islands (Kirchenpauer); Philippine Islands (Allman); Singapore (Marktanner-Turneretscher); Indian waters (Ritchie).

LYTOCARPUS PHILIPPINUS (Kirchenpauer)

Aglaophenia philippina KIRCHENPAUER, Ueber die Hydroidenfamilie Plumularidae, 1872, pt. 1, p. 45.

Aglaophenia urens BALE, Australian Hydroid Zoophytes, 1884, p. 155.

Lytocarpus philippinus BALE, Proceedings Linn. Soc. New South Wales, vol. 3, ser. 2, 1888, p. 786.

This well-known species was secured by the *Albatross* at station 5251, Gulf of Davao, Linao Point, 7° 5′ 12″ N., 125° 39′ 35″ E.; depth 20 fathoms; and at station 5254, same general locality, 7° 5′ 42″ N., 125° 39′ 42″ E.; depth, 21 fathoms. Station 5153, Sulu Archipelago, Tawi Tawi group, Tocanhi Point, 5° 18′ 10″ N., 120° 2′ 55″ E.; depth, 49 fathoms. Station 5165, Sulu Archipelago, Tawi Tawi group, Observation Island, 4° 58′ 20″ N., 119° 50′ 30″ E.; depth, 9 fathoms.

Distribution.—Philippine Islands (Kirchenpauer and Hargitt); Queensland, Australia (Bale); Red Sea (Frauenfeld); Mediterranean (Kattegat); Jamaica, British West Indies, and Panama (Nutting); Bahia, Brazil (Rathbun).

LYTOCARPUS BALEI Nutting

Lytocarpus balei NUTTING, Hydroids of the Hawaiian Islands, 1905, p. 954, pl. 13, figs. 7 and 8.

The specimens secured by the *Albatross* agree fairly well with the type specimen of this species and show the strong septal ridges in the hydrocladia. The *Albatross* material, however, differs in having relatively longer supracalycine nematophores. The gonosome is not present.

Localities.—Station 5141, Sulu Archipelago, vicinity of Jolo, Jolo Light, 6° 9′ N., 120° 58′ E.; depth, 29 fathoms. Station 5147, Sulu Archipelago, vicinity of Sulade Island, 5° 41′ 40″ N., 120° 47′ 10″ E.; depth, 21 fathoms. Station 5149, Sulu Archipelago, vicinity of Sirun Island, 5° 33′ N., 120° 42′ 10″ E.; depth, 10 fathoms. Station 5150, Sulu Archipelago, vicinity of Sirun Island, 5° 23′ 20″ N., 120° 35′ 45″ E.; depth, 21 fathoms.

Distribution.—Hawaiian Islands, off south coast of Molokai, 47–115 fathoms (Nutting).

Genus THECOCARPUS Nutting

Stechow in 1920 relegates the genus *Thecocarpus* to synonymy and replaces it with *Lytocarpia* of Kirchenpauer (1872). But Bedot (1921) rejects Stechow's arguments and reaffirms the validity of *Thecocarpus* Nutting. The present writer believes that the position of Bedot is the stronger and had written out a defense of the genus *Thecocarpus* before Bedot's work came to hand, but prefers to allow the validity of the genus to be maintained by Bedot.

THECOCARPUS BALEI, new species

Plate 47, figs. 1, 2

Trophosome.—Colony plumose, specimen unbranched, 10 cm. high and with a spread of 4 cm., fascicled almost to tip, straight, without evident internodes. Hydrocladia alternate, close-set, borne on one side of the stem, all springing from the same tube (hydrocladiate tube) of the fascicled stem, divided into regular nodes by oblique internodes, each of which bears a hydrotheca. Hydrothecae cup-shaped, rather small for this genus, about one and one-quarter as deep as wide; margin slightly everted, somewhat undulating on the sides, but without evident teeth except a median anterior one which is small but plainly seen. Nematophores, mesial nematophores are large for this genus, not attaining the level of the margin of the hydrotheca, margin finely crenulated and incomplete behind, where the nematophore appears to be obliquely beveled. Supracalycine nematophores just about reaching the level of the hydrothecal rim, projecting outward rather than upward and with a broad everted margin somewhat like the lip of a pitcher. Cauline nematophores are borne on the hydrocladiate tube of the stem.

Gonosome.—The gonangia are inclosed in a corbula in which the leaves are united as in the genus *Aglaophenia*, but there is a hydrotheca at the base of each leaf as is characteristic of *Thecocarpus.* The corbula is extraordinarily long and slender (10 mm. long and 1 mm. in diameter) composed of about 24 pairs of leaves, each with a hydrotheca at its base and bearing a row of six to eight nematophores on its edge. Nematophores tubular with the margin having a deep sinus or bay cut away on one side. These corbulae are really modified hydrocladia having two or three normal hydrothecae on the proximal part between the stem and corbula.

Localities.—Dredging station 5134, Sulu Archipelago, Balukbaluk Island, 6° 44′ 45″ N., 121° 48′ E.; depth, 25 fathoms. Station 5335, Linapacan Strait, Observatory Island, 11° 37′ 15″ N., 119° 48′ 45″ E.; depth, 46 fathoms.

Holotype.—Cat. No. 42185, U.S.N.M.

The writer takes pleasure in naming this species after the veteran Australian naturalist and authority on the Hydroida, W. N. Bale. This species is nearest *Aglaophenia calycifera* Bale but is without the cap-like sarcothecae which Bale regards as a diagnostic feature.[29]

HALICORNARIA HIANS (Busk)

Plumularia hians Busk, Voyage of the Rattlesnake, 1852, vol. 1, p. 396.
Halicornaria hians Bale, Australian Hydroid Zoophytes, 1884, p. 179.

Our specimens correspond quite closely with the figures and description given by Bale.

Locality.—Dredging station 5321, China Sea, vicinity of Formosa, Ibugos Island, 20° 19′ 30″ N., 121° 51′ 15″ E.; depth, 26 fathoms.

Distribution.—Prince of Wales Channel, Torres Strait (Busk); Sagami Sea, Japan (Inaba, according to Stechow).

HALICORNARIA TENUIROSTRIS, new species

Plate 47, figs. 3, 4

Trophosome.—Colony plumose, 11 cm. high and with a spread of 4 cm. Stem not fascicled, divided into irregular internodes, giving off alternate closely approximated hydrocladia. The nodes are more distinct on the distal than on the proximal parts; but divide internodes of irregular length. Hydrocladia springing from the front of the main stem, but inclined alternately to right and left and are divided into internodes by indistinct nodes, each internode of the main stem bearing a hydrocladium. Hydrothecae cup-shaped, one and one-half times as long as wide, distal part bent somewhat outward and the aperture opening at an angle of about 45° with the axis of the hydrocladium. Marginal teeth vary considerably, but are often more prominent than is usual in this genus, there being two lobe-like or bluntly pointed lateral teeth and a sharply pointed median or front tooth. The anterior intrathecal ridge characteristic of this genus is well marked and proceeds from a strong indentation about half way up the front of the hydrotheca, showing in profile as a doubly curved line reaching more than half way across the hydrotheca. Nematophores, supracalycine nematophores roughly triangular in outline, their tops not nearly reaching the level of the top of the hydrotheca and aperture round. Mesial nematophores very narrow, tubular, closely adherent to the front of the hydrotheca almost or quite throughout their length and not reaching the top of the hydrotheca. Their front profile is straight or with a slight double curve. There is a partial septum opposite the intrathecal ridge.

---

[29] Hydroids collected in the Great Australian Bight, pt. 2, 1914, p. 178.

Gonosome.—Not present.

Locality.—Dredging station 5251, Gulf of Davao. Linao Point. 7° 5′ 12″ N., 125° 39′ 35″ E.; depth, 20 fathoms.

Holotype.—Cat. No. 42186, U.S.N.M.

This species is nearest my *Halicornaria flava* from Hawaiian waters or *H. ishikawai* Stechow from which it differs in the prominence of the hydrothecal teeth and the slenderness of the mesial nematophores as well as in certain characters of the stem.

(?)HALICORNARIA MAGNIROSTRIS, new species

Plate 47, figs. 5, 6

Trophosome.—Colony an aggregation of pinnate stems growing from a creeping root stalk, stem fascicled, hydrocladia alternate, very closely approximated and set on opposite sides of the branch or stem from which they spring; divided into regular hydrothecate internodes and showing intercladial ridges just above the mesial nematophores and two others, one above and one below the supracalycine pair. Hydrothecae of the usual *Halicornaria* type with an interior intrathecal ridge and a sharp bay or sinus on its front margin just above where the mesial nematophore becomes free; margin with a rather sharp anterior tooth and two lateral lobular teeth, the hindmost being partially hidden by the supracalycine nematophore.

The intrathecal ridge is short but strong. Nematophores, the supracalycine pair are large blunt thumblike in form with a terminal orifice pointing upward and rising slightly above the hydrothecal rim. Mesial nematophores enormous, almost equal to the hydrotheca in diameter and reaching far beyond the hydrothecal margin. They are free from the front of the hydrotheca above the intrathecal ridge and sometimes this free portion equals the entire hydrotheca in length. There is a small round opening from the nematophore into the hydrotheca below the intrathecal ridge and another on the distal end of the nematophore. The nematocysts borne by these mesial nematophores are very long and narrow and a bundle of their very complex threads is often seen projecting from the distal opening of the nematophore. There is a very large nematophore resembling the mesial ones near the base of each hydrocladium between the first and second hydrothecae but projecting from the side of the hydrocladium end at a right angle to the axis of the ordinary mesial nematophore. Indeed, it looks like a misplaced mesial nematophore although more nearly in the position of the supracalycine nematophores.

Gonosome.—Not present.

Localities.—Dredging station 5139, vicinity of Jolo, Jolo Light, 6° 6′ N., 121° 2′ 30″ E.; depth, 20 fathoms. Station 5165, Sulu Archipelago, Tawi Tawi group, Observation Island, 4° 58′ 20″ N., 119° 50′ 30″ E.; depth, 9 fathoms.

Holotype.—Cat. No. 42187, U.S.N.M.

The propriety of placing this extraordinary form in the genus *Halicornaria* is doubtful. Indeed, in the absence of the gonosome it is almost impossible to distinguish that genus from *Lytocarpus*.

BIBLIOGRAPHY

ALDER, JOSHUA. A Catalogue of the Zoophytes of Northumberland and Durham, Transactions of the Tyneside Naturalists' Field Club, vol. 3, 1857.

ALLMAN, GEORGE J. Report on the Hydroida collected during the exploration of the Gulf stream, Memoirs of the Museum of Comparative Zoölogy at Harvard College, vol. 5, No. 2, 1877.

———— Report on the Hydroida dredged by H. M. S. *Challenger*, pt. 1, 1883, pt. 2, 1888.

BALE, WILLIAM M. Journal Microscopic Society Victoria, 1881.

———— Catalogue of Australian Hydroid Zoophytes, 1884.

———— The Genera of the Plumularidae, etc., 1887.

———— Some New and Rare Hydroida in the Australian Museum Collection, Proceedings of the Linnean Society, New South Wales, vol. 3, ser. 2, 1888.

———— Report on the Hydroids collected in the Great Australian Bight, 1914.

———— Transactions and Proceedings of Royal Society of Victoria, 1914, new ser., vol. 27.

Bedot, M. Notes systématiques sur les Plumularides, two parts, 1921.

Billard, Armand. Note critique sur divers genres et espèces d'Hydroïdes in Revue Suisse de Zoologie, vol. 31, No. 2, May, 1914.

Busk, G. An account of the Polyzoa and Sertularian Zoophytes, collected in the voyage of the *Rattlesnake* on the coasts of Australia and Louisiade Archipelago, etc. Voyage of the *Rattlesnake*, vol. 1, Appendix No. 4, 1852.

Ellis and Solander. The Natural History of Many Curious and Uncommon Zoophytes, 1786.

Esper, E. J. C. Die Pflanzenthiere in Abbildungen nach der Natur mit Farben erleuchtet, vol. 3, 1788.

Fraser, C. M. Some Hydroids from Beaufort, N. C., Bulletin Bureau of Fisheries, vol. 30, 1910 (1912).

Hargitt, Charles W. Notes on a few Coelenterates of Woods Holl, Contributions Zoological Laboratory of Syracuse University, 1908.

——— Hydroids of the Philippine Islands, Philippine Journal of Science, vol. 24, No. 4, 1924.

Inaba, Hydroids of the West Coast Kishu, 1892.

Jäderholm, Elof. Ueber Aussereuropäische Hydroiden des Zoologischen Museums der Universität Upsala, 1896.

Kirchenpauer, G. H. Ueber die Hydroidenfamilie Plumularidae, pt. 1, 1872, and pt. 2, 1876.

Lamouroux, J. F. V. Histoire des Polypiers Coralligènes Flexibles vulgairement nommés Zoophytes, 1816.

Levinsen, G. M. R. Meduser, Ctenophorer og Hydroider fra Grönlands Vestkyst tilligemed Bemaerkninger om Hydroidernes Systematik, 1892.

Linnaeus, C. Systema Naturae, 10th edition. 1758.

Marktanner-Turneretscher. Die Hydroiden des k. k. naturhistorischen Hof museums, 1890.

Mulder and Trebilcock. Geelong Naturalist, vol. 4, ser. 2, 1909.

Nutting, C. C. Hydroids from Alaska and Puget Sound, Proceedings of the U. S. National Museum, vol. 21, 1899.

———American Hydroids, pt. 1, 1900; pt. 2, 1904; and pt. 3, 1915.

———Hydroids of the Harriman Alaska Expedition, Proceedings of the Washington Academy of Sciences, vol. 3, pp. 157–216, 1901.

———Hydroids of the Hawaiian Islands collected by the Steamer *Albatross* in 1902, U. S. Fish Commission Bulletin for 1903, pt. 3, 1905.

Ritchie, James. The Hydroids of the Indian Museum, No. 1, 1910.

Sars, G. O. Vidensk. Selsk. Forhandl., Christiania, 1862.

Stechow, E. Beitrage sur Kenntnis von Branchiocerianthus imperator (Allman), München, 1908.

———Hydroidenpolypen der japanischen Ostküste, pt. 2, 1913.

———Neue Genera thecates Hydroiden und Neue Species von Thecaten aus Japan, Dec. 2, 1913.

———Zur Kenntnis neuer oder seltener Hydroidpolypen, 1914.

———Zur Kenntnis der Hydroidenfauna des Mittelmeeres, Amerikas und anderer Gebiete, pt. 1, 1919, pt. 2, 1923.

———Neue Hydroiden der Deutschen Tiefsee Expedition nebst Bemerkungen über einige andere Formen, 1923.

Thornely, Laura R. The Hydroid Zoophytes collected by Dr. Willey in the Southern Seas, Willey's Zoological Results, pt. 4, Cambridge University Press, 1899.

EXPLANATION OF PLATES

PLATE 40

FIG. 1. *Stegopoma dimorpha.* Hydrothecae (enlarged).
2. *Stegopoma dimorpha.* Small type of gonangium (enlarged).
3. *Stegopoma dimorpha.* Large type of gonangium (enlarged).
4. *Hebella spiralis.* Part of colony (enlarged).
5. *Hebella spiralis.* Hydrotheca (enlarged).
6. *Hebella spiralis.* Hydrotheca (enlarged).

PLATE 41

FIG. 1. *Acryptolaria normani.* Hydrothecae (greatly enlarged).
2. *Acryptolaria normani.* Hydrothecae (enlarged).
3. *Zygophylax curvitheca.* Gonangia (enlarged).
4. *Dictyocladium aberrans.* Hydrothecae (enlarged).
5. *Dictyocladium aberrans.* Gonangium (enlarged).

PLATE 42

FIG. 1. *Sertularella cornuta* Stechow. Hydrothecae (enlarged).
2. *Sertularella cornuta* Stechow. Gonangia (enlarged).
3. *Sertularella mirabilis* Jäderholm. Gonangium (enlarged).
4. *Sertularella mirabilis* Jäderholm. Gonangium (greatly enlarged).
5. *Diphasia heurteli* Billard. Hydrothecae (enlarged).
6. *Diphasia heurteli* Billard. Gonangium, side view (enlarged).
7. *Diphasia heurteli* Billard. Gonangium. front view (enlarged).

PLATE 43

FIG. 1. *Diphasia inornata.* Hydrothecae and gonangium (enlarged).
2. *Plumularia aglaophenoides* Bale. Hydrothecae (enlarged). (After Bale).
3. *Plumularia aglaophenoides* Bale. Gonangium (greatly enlarged).
4. *Plumularia flabellata.* Hydrothecae (enlarged).
5. *Plumularia flabellata.* Hydrothecae (greatly enlarged).

PLATE 44

FIG. 1. *Plumularia hargitti.* Hydrothecae (enlarged).
2. *Plumularia hargitti.* Gonangium (enlarged).
3. *Plumularia camarata.* Part of branch (enlarged).
4. *Plumularia camarata.* Three hydrothecae (greatly enlarged).
5. *Antennella biarmata.* Hydrothecae (enlarged).
6. *Antennella recta.* Hydrotheca (greatly enlarged).
7. *Antennella recta.* Hydrothecae (enlarged).

PLATE 45

FIG. 1. *Acanthella effusa* (Busk). Gonangia (enlarged).
2. *Acanthella effusa* (Busk). Gonangia (greatly enlarged).
3. *Antennopsis pacifica.* Part of branch (enlarged).
4. *Antennopsis pacifica.* Hydrotheca (greatly enlarged).

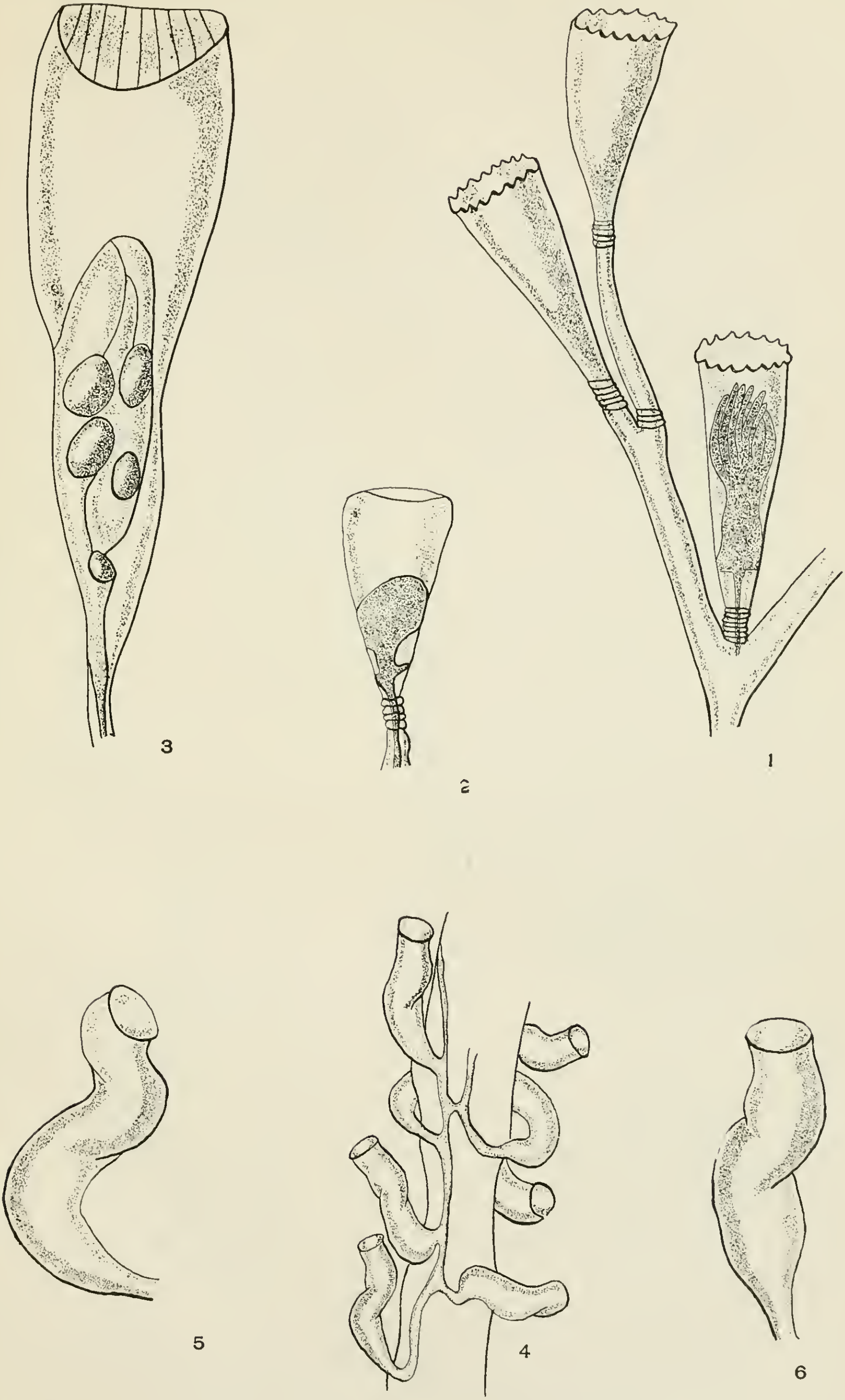
Plate 46

Fig. 1. *Stechowia armata.* Part of branch with gonangia (enlarged).
2. *Stechowia armata.* Hydrotheca (greatly enlarged).
3. *Aglaophenia triramosa.* Hydrotheca (greatly enlarged).
4. *Aglaophenia triramosa.* Corbula (enlarged).

Plate 47

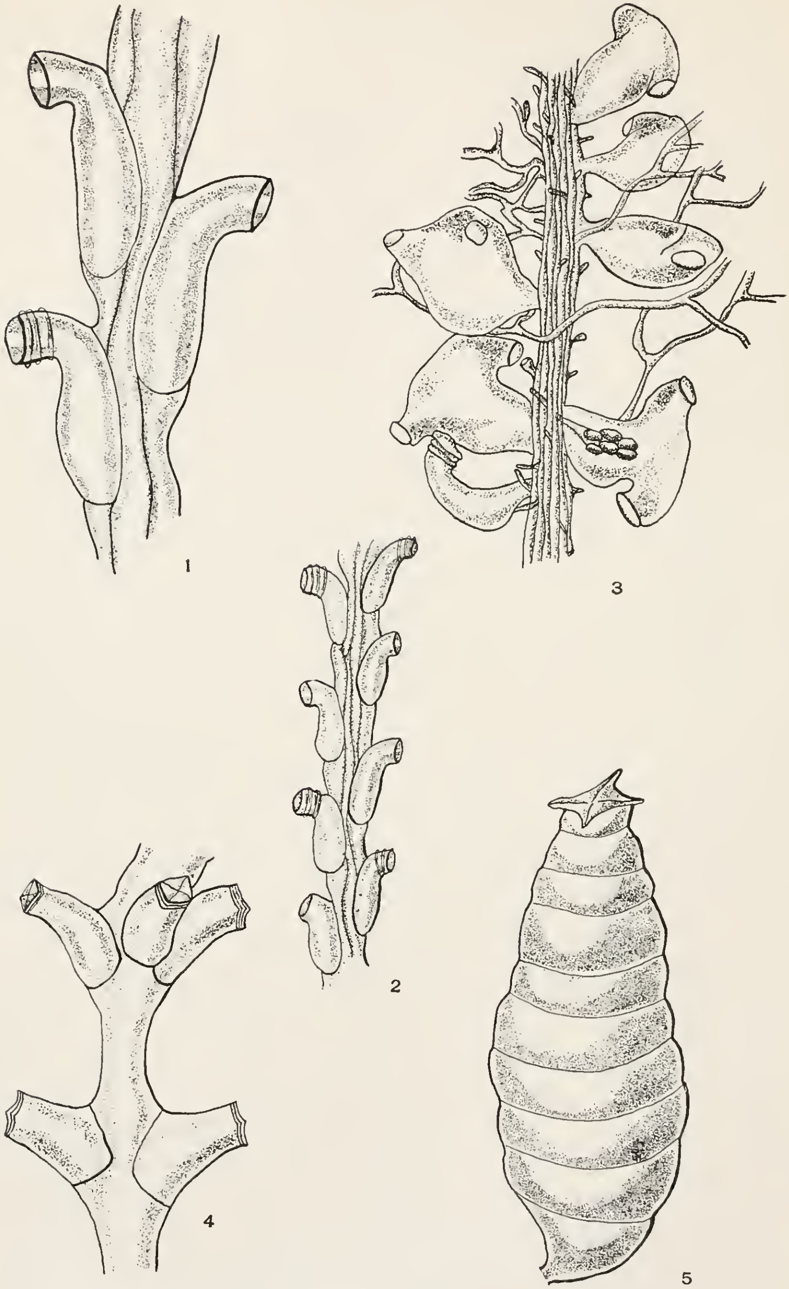
Fig. 1. *Thecocarpus balei.* Two hydrothecae (greatly enlarged).
2. *Thecocarpus balei.* Corbula (enlarged).
3. *Halicornaria tenuirostris.* Part of hydrocladium (enlarged).
4. *Halicornaria tenuirostris.* Two hydrothecae (greatly enlarged).
5. *Halicornaria magnirostris.* Two hydrothecae (greatly enlarged).
6. *Halicornaria magnirostris.* Hydrothecae to show giant nematophores (enlarged).

ADDITIONAL COPIES
OF THIS PUBLICATION MAY BE PROCURED FROM
THE SUPERINTENDENT OF DOCUMENTS
GOVERNMENT PRINTING OFFICE
WASHINGTON, D. C.
AT
15 CENTS PER COPY
▽



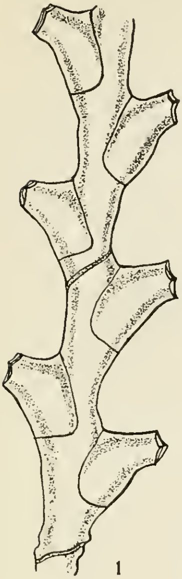
New Species of Stegopoma and Hebella

For explanation of plate see page 241

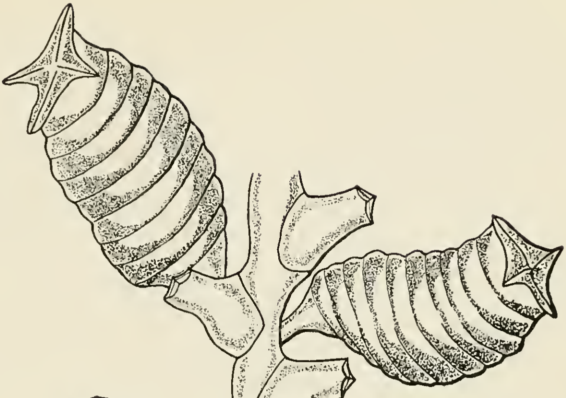


New Species of Acryptolaria, Zygophylax, and Dictyocladium

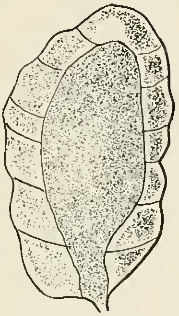
For explanation of plate see page 241



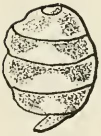
1



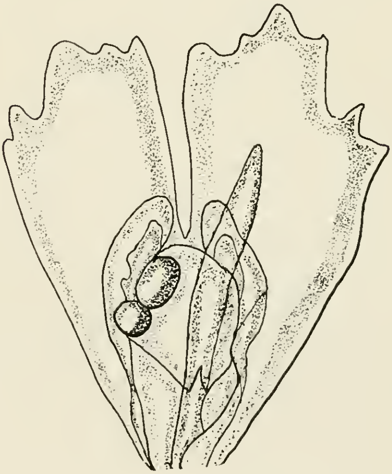
2



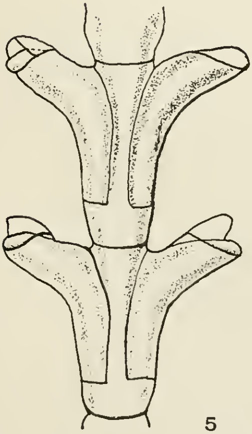
4



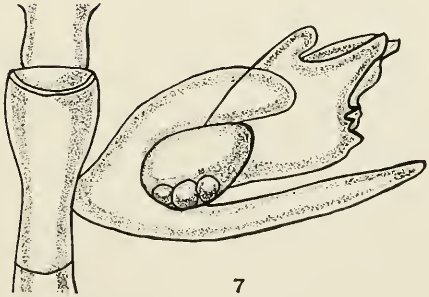
3



6



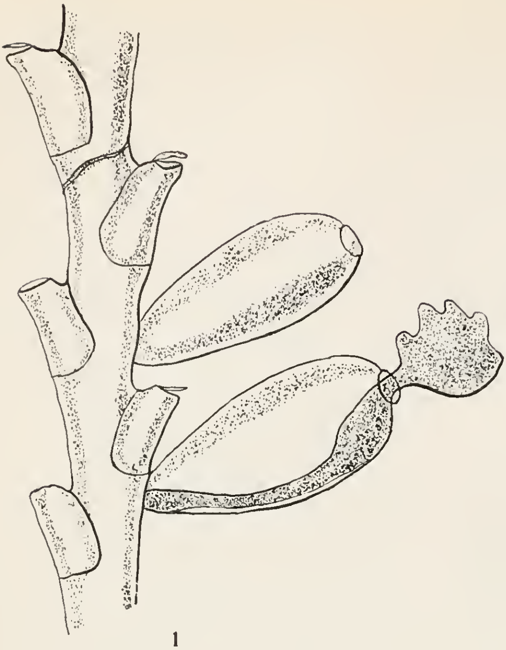
5



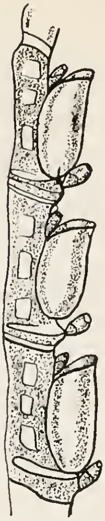
7

GONOSOMES OF SERTULARELLA AND DIPHASIA

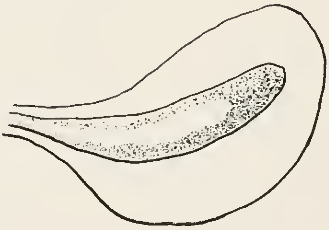
FOR EXPLANATION OF PLATE SEE PAGE 241



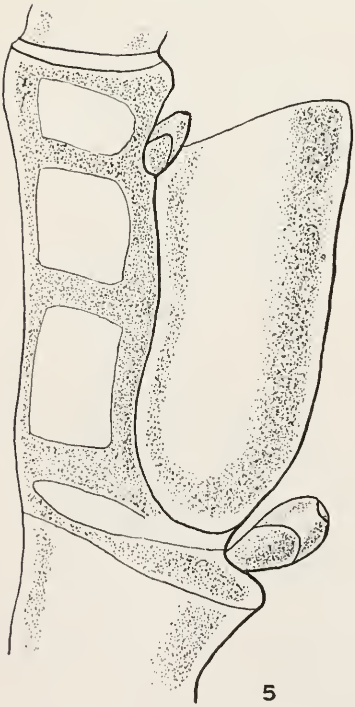
1



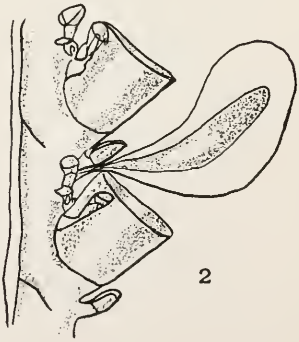
4



3



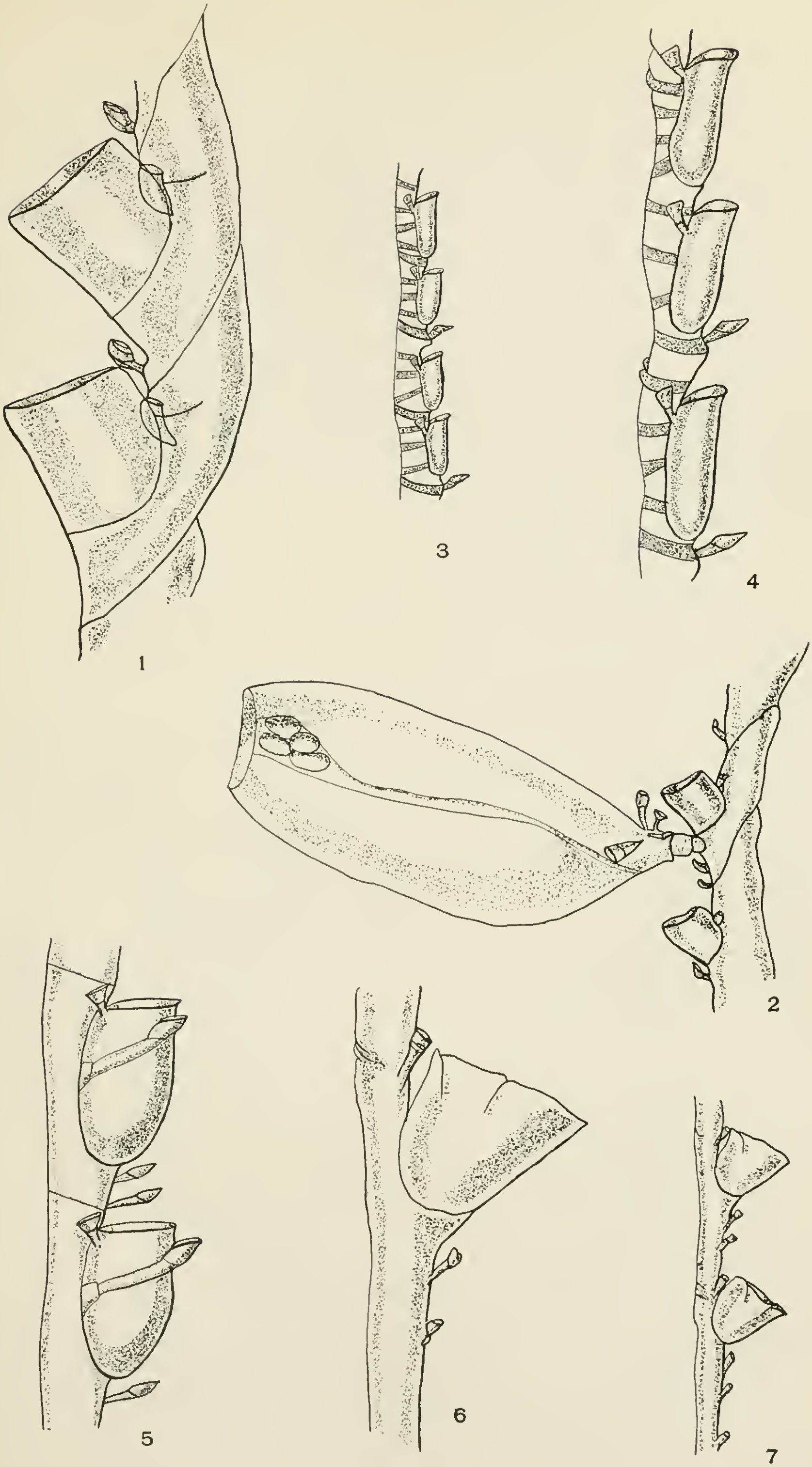
5



2

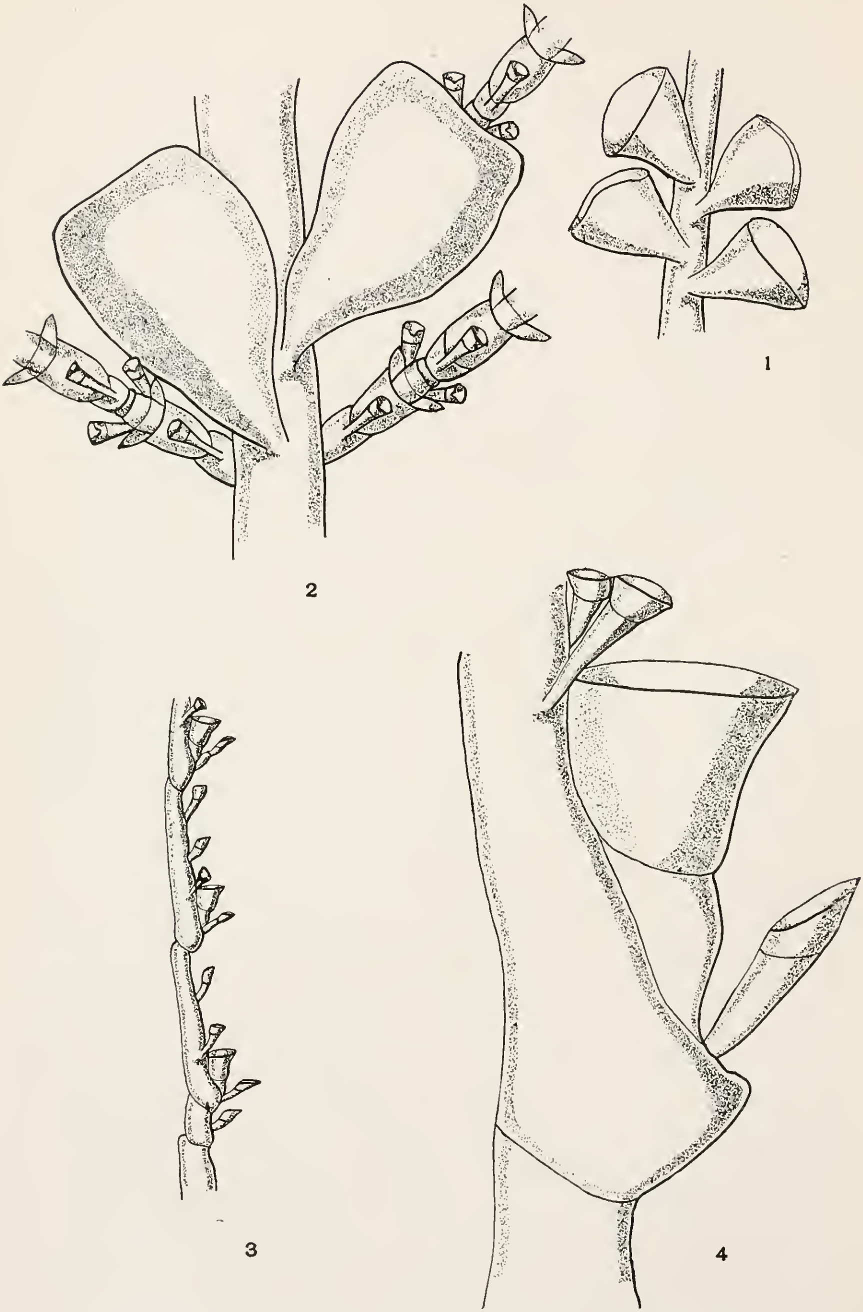
New Species of Diphasia and Plumularia

For explanation of plate see page 241



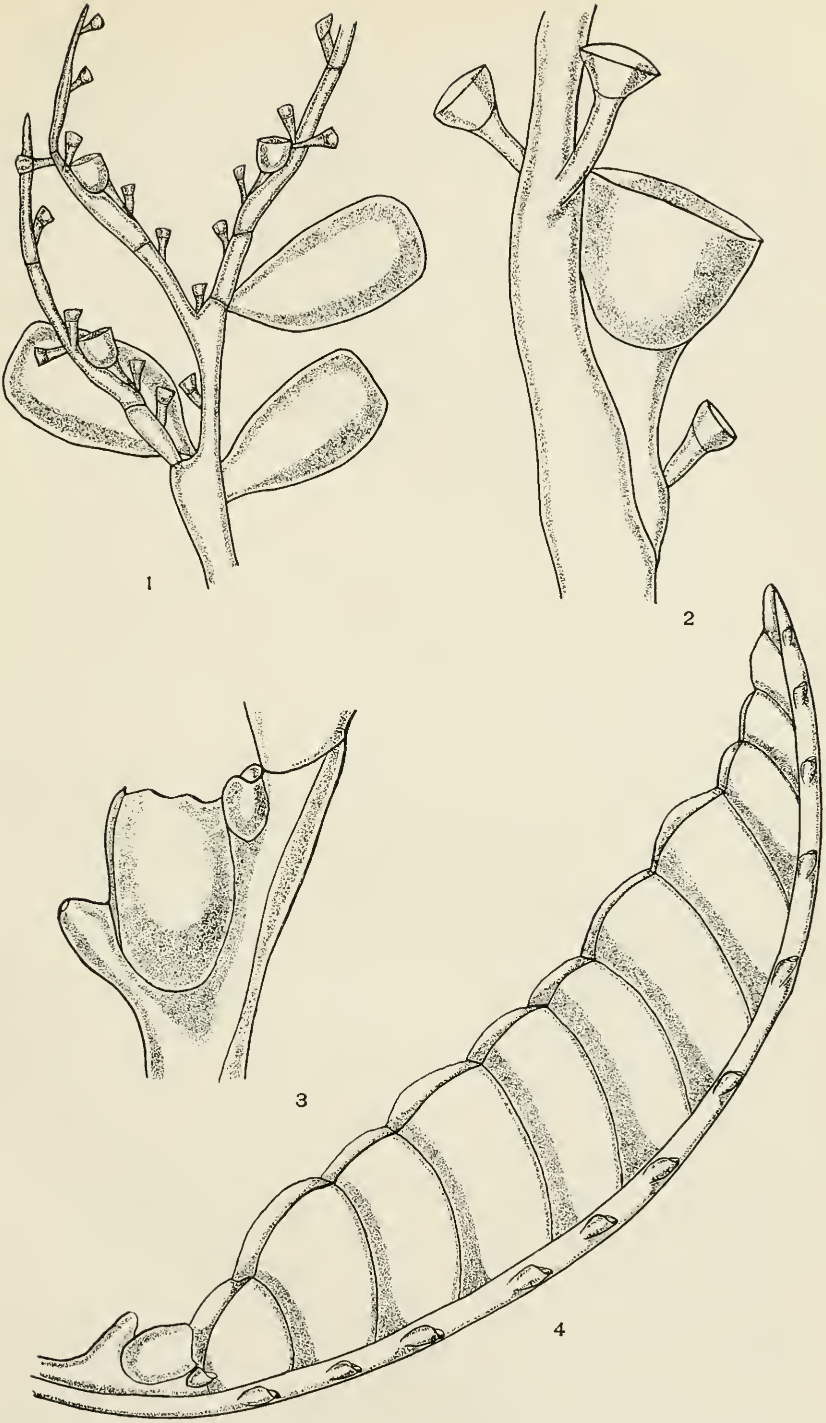
New Species of Plumularia and Antennella

For explanation of plate see page 241



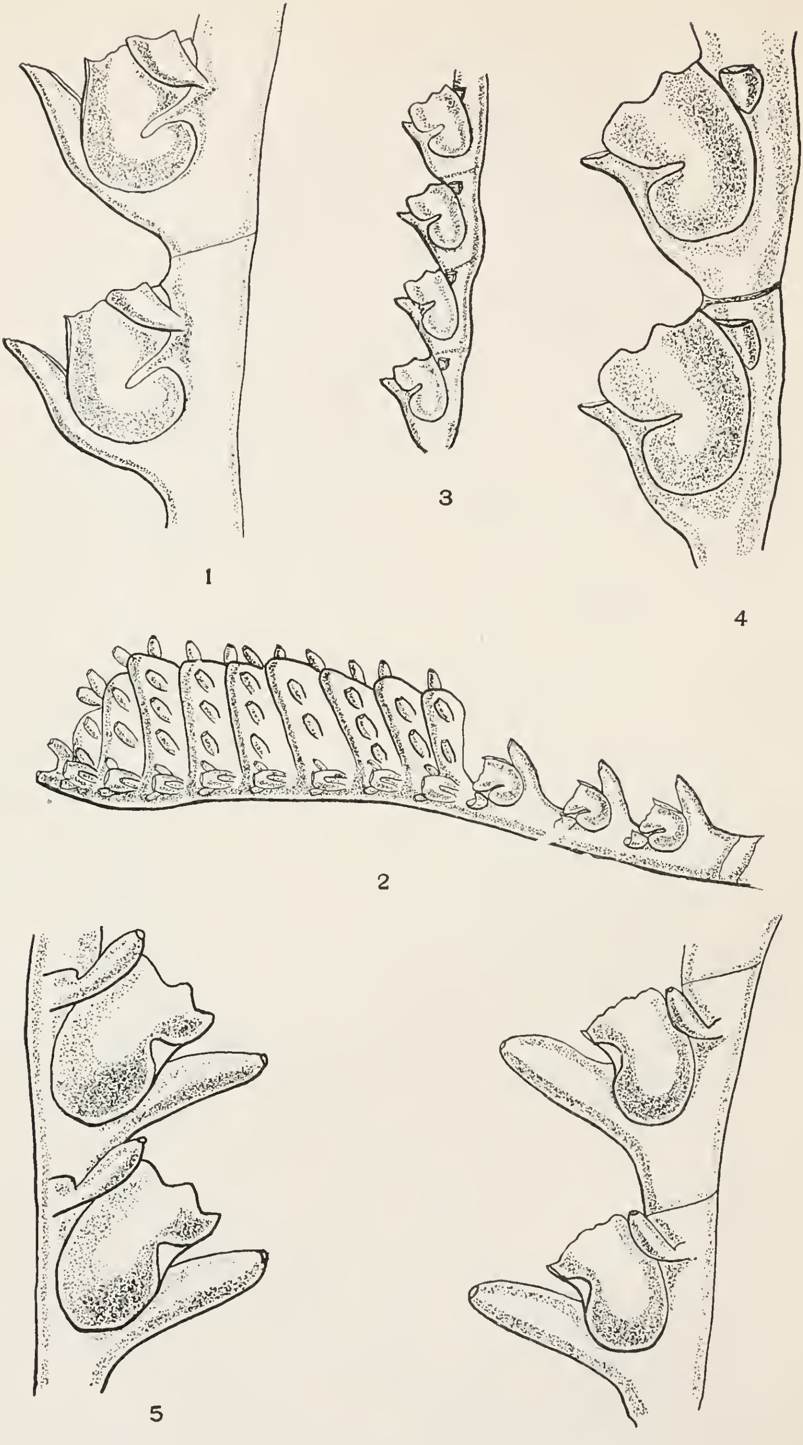
GONOSOME OF ACANTHELLA AND A NEW SPECIES OF ANTENNOPSIS

FOR EXPLANATION OF PLATE SEE PAGE 241



New Genus Stechowia and New Species of Aglaophenia

For explanation of plate see page 242



New Species of Thecocarpus and Halicornaria

For explanation of plate see page 242

REPORT ON THE ECHINOIDEA COLLECTED BY THE UNITED STATES FISHERIES STEAMER "ALBATROSS" DURING THE PHILIPPINE EXPEDITION, 1907–1910. PART I. THE CIDARIDAE

By Theodor Mortensen
Of the Zoological Museum, University of Copenhagen, Denmark

INTRODUCTION

In presenting herewith the first part of the Report on the Echinoids, collected by the *Albatross* Philippine Expedition, the author begs to express his sincere thanks to the authorities of the United States Bureau of Fisheries, of the Department of Commerce, and of the United States National Museum for the privilege of working up this most important collection. Special thanks are due to Mr. Austin H. Clark, the Curator of Echinoderms in the United States National Museum, as also to Dr. H. L. Clark, Museum of Comparative Zoology, Harvard College, Prof. R. Koehler, Lyon, and Prof. L. F. de Beaufort, director of the Zoological Museum, Amsterdam, for much important help in various ways in connection with this work.

The work was begun several years ago, but had to be laid aside for some time on account of the author's absence during his expeditions to the Pacific in 1914–1916 and to the Kei Islands in the Malay Archipelago in 1922. The delay thus caused in the working up of the collection is, however, far outweighed by the fact that the ample echinoid material brought together by the author from various parts of the Pacific region has proved to be of the greatest importance for the study of the *Albatross* collection. Thus it may well be said that without the goniocidarids, collected by the author at the Kei Islands, it would hardly have been possible to have reached a satisfactory conclusion in regard to various small goniocidarids in the *Albatross* collection—*Rhopalocidaris hirsutispina,* var. *viridis, Schizocidaris serrata,* and *Schizocidaris fasciata.*

The present first part of the report on the *Albatross* echinoids deals only with the family Cidaridae. The number of species and varieties of this family represented in the collection amounts to 27. Of these, 6 species and 7 varieties are new to science, 2 of them representing new genera and 1 a new subgenus. Two of the new species, *Histocidaris magnifica* and *Goniocidaris* (*Discocidaris*) *peltata*, are among the most magnificent cidarids known. Each of them is represented only by a single, fortunately very beautifully preserved, specimen. The new genus *Psilocidaris* is especially interesting, being evidently related both to the genus *Aporocidaris* and to the genus *Goniocidaris* (in the broad sense), and thus giving the clue to the true systematic position of *Aporocidaris*, the affinities of which were hitherto rather obscure.

The number of species (and varieties) of cidarids, collected by the *Albatross* in the Philippine seas, considerably exceeds that collected by the *Siboga* from the whole of the Malay region which amounted to 18 (19) species. Only 9 species are represented in both collections, while 18 species were taken only by the *Albatross*, as against 9 species taken solely by the *Siboga*. As several species of cidarids not represented in either the *Albatross* or the *Siboga* collections were taken by the author, mainly at the Kei Islands (also one at the Philippines), the total number of species of cidarids known from the Malayan and Philippine seas already amounts to more than 40. Since several of these are represented only by single specimens, it is safe to say that our knowledge of the cidarids of this region is still far from complete. We may well expect that a fair number of additional species will be brought to light there by further investigations, so that the total number of species of cidarids occurring in this region will very probably amount to about 50. Comparison between this number and the 8 (perhaps 10) species of cidarids known from the West Indies and 3 or 4 species known from the whole of the northeast Atlantic very strikingly demonstrates how extraordinarily richly the cidarids are represented in the Philippine-Malayan seas, evidently more richly than in any other part of the world.

Order CIDAROIDEA

Family CIDARIDAE

Genus HISTOCIDARIS Mortensen

HISTOCIDARIS MAGNIFICA, new species

Plates 48–49; 76, figs. 1–3

Locality.—Station 5547; near Joló (Sulu); Tulayan Island (E.) bearing S. 38° E., 9.5 miles distant (lat. 6° 09′ 20″ N., long. 121° 13′ 40″ E); 283 meters; bottom temperature 13.50° C.; fine sand; September 15, 1909 (1 specimen, the type, Cat. No. E. 5547, U.S.N.M.).

Measurements

h. d.	v. d.	Apical system	Peristome	Number of—		Longest spines
				I. a.	A. pro I. a.	
77 mm.	57 mm.	30 mm. (39 per cent h. d.)	About 20 mm. (26 per cent h. d.)	12	11–12	About 100 mm.

Description.—The shape of the test is almost perfectly globular, though it is uncertain whether or not there is a slight flattening of the oral side, as it did not seem desirable to remove the perfectly preserved spines of the oral side in order to ascertain this, which for the description of the species is a rather unimportant detail.

The ambulacra are fairly broad, 10 mm. or 28.6 per cent of the interambulacra, which latter measure 35 mm. in breadth at the ambitus. The interporiferous zone is 3.3 mm. broad, thus almost exactly as broad as each poriferous zone. Both pores are unusually broad, separated only by a very narrow and scarcely projecting wall. The plates are very low, the pairs of pores therefore lying very closely one above another. Also the marginal series of tubercles is very crowded, the tubercles being nearly in contact, though rather small. (Fig. 1.) The marginal series is very regular. Inside the marginal series there is at the ambitus and farther downward a fairly regular series of smaller tubercles on each side; above the ambitus the inner series become irregularly alternating, totally disappearing in the upper part, where the interporiferous zone gradually becomes much narrower.

The primary tubercles of the interambulacra are strongly crenulate, the areoles nearly confluent, except the three upper ones, the following three being separated only by a very narrow ridge, carrying a series of very small tubercles. The areoles are broad, transversely oval, and not deepened. The median area is fairly broad, slightly more than half as broad as the areoles. Outside the rather prominent scrobicular ring there are several very small tubercles, not regularly arranged, leaving a rather distinct bare median line, which is hardly at all sunken. In the corner between each two areoles there may be, at the ambitus, a single larger tubercle of the same size as those of the scrobicular ring. The adradial part of the interambulacral plates carries outside the scrobicular ring some rather closely set smaller tubercles, leaving, however, a conspicuous bare margin.

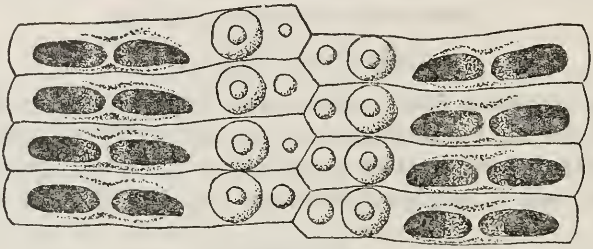
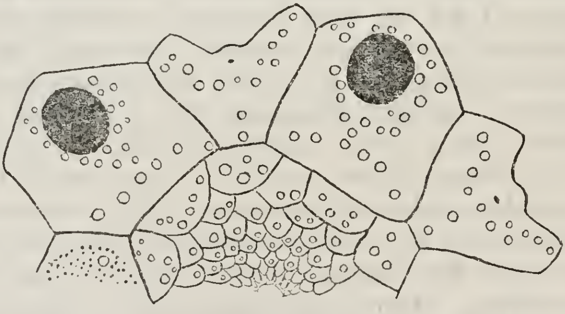


FIG. 1.—PART OF AMBULACRUM OF HISTOCIDARIS MAGNIFICA, NEW SPECIES. ×7.5

The apical system is somewhat arched, in continuation of the regular arching of the test. The ocular plates are deeply sinuate on the outer edge, and are in contact with the periproct, excepting for the two joining the large madreporic plate. The genital plates are narrow, with large genital openings, which lie entirely within the plate. Tubercles are few, as is usual in this genus, being confined mainly to the circumference of the genital pores, a single arched series occurring proximally on the genital plates, and to a half circle along the outer edge and one or two proximally on the ocular plates. The periproctal plates are rather closely tuberculated. (Fig. 2.) The peristome has not been examined in detail, as this could not be done without doing harm to the splendid specimen.



FIG, 2.—PART OF APICAL SYSTEM OF HISTOCIDARIS MAGNIFICA, NEW SPECIES. ×2.5

The primary spines at the ambitus are not very long, the longest preserved being only about 100 mm. in length by a thickness of 3.5 mm., not tapering. Possibly there may have been a few slightly longer, but it may be said with certainty that the longest can only very slightly have exceeded 1 ½ h. d. In the present specimen the upper spines taper to a point and are much shorter than those at the ambitus, though fully developed, as is evident from the character of their surface, which means that the specimen has reached its full size. The spines are perfectly smooth, shining, at most with a pair of indistinct longitudinal ridges, without any serrations. Even under the microscope no longitudinal striation is to be observed. The collar is short, 3–4 mm. in length, widening toward the milled ring. The oral primaries are of the typical form, curved, strongly serrate, with a smooth point, ending abruptly, not bifid as may be the case in some species (*elegans*, *acutispina*); but this may be due to the point being worn. The two proximal ones are fairly broad, the third is more slender, and the fourth is only recognizable as an oral primary through its strong lateral serration; the fifth and sixth still carry some small lateral serrations, being transitional forms. From the third onward the spines have the point slightly widened, longitudinally serrate, ending abruptly as if worn off. This also holds good for the longest spines at the ambitus, which are directed downward, partly even slightly curved. Evidently the animal has been walking on the points of all these spines, only the shorter spines above the ambitus being directed upwards.

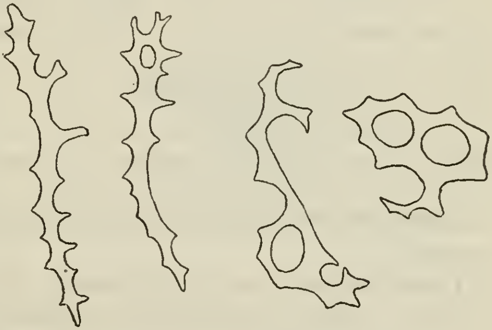


Fig. 3.—Spicules from tube feet of Histocidaris magnifica, new species. ×240

The secondary spines surrounding the primaries are fairly robust, about 12 mm. long, broad, distinctly excavate on the outside, especially toward the end, which is not at all or only slightly narrowed. (Pl. 76, figs. 1–2.) This excavation is especially conspicuous on the spines below the ambitus. The ambulacral spines are about 8–10 mm. long, very slender, almost setaceous, and erect.

The pedicellariae have the heads about 5 mm. long; the valves (pl. 76, fig. 3) are slender, the blade being filled with the usual meshwork, with no depression above the apophysis. The smaller forms are not peculiar, all transition stages being found between the large and the small ones.

The spicules of the tube feet are rather small more or less fenestrated rods, and are irregularly scattered. Toward the end of the tube feet they become somewhat larger fenestrated plates. (Fig. 3.)

The color of test and secondary spines is dark brownish the primaries whitish-brownish with the collar somewhat darker.

Remarks.—This splendid large species is very markedly distinct from all the other species of this genus hitherto known; it does not seem very closely related to any of them.

HISTOCIDARIS ACUTISPINA, new species

Plate 50, figs. 1, 2; plate 52, fig. 2; plate 77, fig. 4

Localities—Station 5429, near eastern Palawan; Fondeado Island (SE.) bearing N. 18° E., 15 miles distant (lat. 9° 41′ 30″ N., long. 118° 50′ 22″ E.); 1,401 meters; green mud; April 5, 1909 (a few primary spines, Cat. No. E. 1285, U.S.N.M.).

Station 5495, between Leyte and Mindanao; Diuata Point (N.) bearing S. 76° E., 9.4 miles distant (lat. 9° 06′ 30″ N., long. 125° 00′ 20″ E.); 1,785 meters; bottom temperature 11.28° C.; gray mud; August 2, 1909 (1 specimen, the type, Cat. No. E. 1275, U.S.N.M.).

Measurements

h. d.	v. d.	Apical system	Peristome	Number of—	
				I. a.	A. pro I. a.
20 mm	14 mm	10.5 mm. (52.5 per cent h. d.)	8 mm. (40 per cent h. d.)	7 (6)	8-9

Description.—In shape the test is rather low, with the sides gently curving.

The ambulacra are 3 mm. broad, the interporiferous zone being 1.2 mm. broad, thus slightly broader than each poriferous zone.

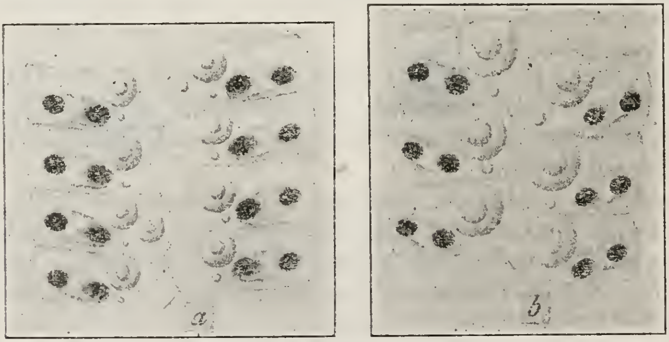


Fig. 4.—Part of ambulacrum of Histocidaris acutispina, new species (*a*) and of Histocidaris, species (*b*) × 12

The marginal series of tubercules is regular, the tubercules being small and relatively distant; within the marginal series there is only here and there a small tubercule, the zone being thus almost wholly naked; it is not sunken. The pores are subequal in size, the inner one only indistinctly the larger. The wall between the pores is very little prominent. (Fig. 4*a*.)

The primary interambulacral tubercules are distinctly crenulate; the areoles are confluent except for the two or three upper ones and are not deepened. The middle area is narrow, scarcely half as broad as the areole. There is thus hardly room for any tubercules except those of the scrobicular ring, which are small and little prominent. The outer adradial part of the interambulacral plates is very narrow, with no tubercules outside those of the scrobicular ring. There is a narrow naked median line in the interambulacra which is slightly depressed.

The apical system (fig. 5) is rather elevated; the oculars come near the periproct, which probably means that in adult specimens they are insert. Genital openings have only just been formed. The tubercules are few, and are confined mainly to the middle of the plates, as is usual in this genus. It appears that the interambulacral plates of the peristome have just begun to form.

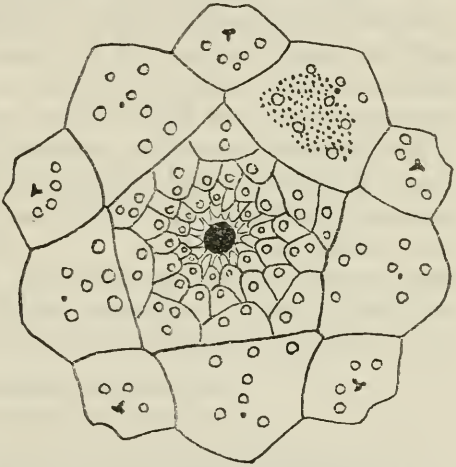


Fig. 5.—Apical system of Histocidaris acutispina, new species. ×5

The primary spines are very long, about four times the horizontal diameter. (Probably the length will prove to be relatively less in adult specimens.) They are very slender, scarcely tapering at all. Of the isolated spines from station 5429—which evidently belong to this species—the longest is 116 mm., with a thickness of 2 mm. They are very coarsely spinous through bearing spinules directed obliquely forward which may show a more or less distinct arrangement in three or four longitudinal series in the basal part, but otherwise are without any serial arrangement. (Pl. 52, fig. 2.) The surface of the spines is otherwise very smooth and shining, with only the faintest indication of a longitudinal striation when seen under the microscope. The collar is short, only 2–3 mm. in length, thickening only very inconsiderably downward. Some of the spines are more or less widened at the tip; one of them has a small thickening in the middle, due probably to some parasitic organism; the outer layer is partially lacking here. One of the spines has a terminal portion of nearly 20 mm. as yet undifferentiated. The oral primaries (in the specimen in hand only the three proximal ones) are as usual strongly serrate and curved; they are very slender.

The secondary spines surrounding the primary spines are about 4 mm. long, flattened, very slender, and only very little broadened at the base. Those of the ambulacra are simply setaceous, erect, almost as long as those around the primary spines.

The pedicellariae are up to about 3 mm. in length of head, with slender, elongate valves (pl. 77, fig. 4); the blade is filled with a close meshwork, with more or less distinct longitudinal crests; there is no depression above the apophysis.

The spicules of the tube feet are of the usual type.

The color of the test and secondary spines is light yellowish brown; the primaries are white, with the collar faintly yellowish brown like the test.

Remarks.—The highly characteristic primary spines make this species easily distinguishable from *H. elegans*, to which otherwise it is apparently the nearest related. Probably also the secondary spines and the apical system will be found to offer good distinguishing characters when once the adult form comes to hand, while the pedicellariae are not very different from some forms of those of *H. elegans*.

The spines of a specimen dredged off Somaliland by the German Deep-sea Expedition[1] (*Valdivia*), referred to *H. elegans* by Doderlein, to some degree resemble those of the present species; still this specimen hardly belongs here. It is noteworthy especially that the spinules on the spines are distinctly arranged in longitudinal series, as is not the case in the present species. Döderlein gives no information concerning the details of the structure of these spines.

HISTOCIDARIS ELEGANS (A. Agassiz)

Plate 52, fig. 1; plate 77, figs. 1–3

Porocidaris elegans A. Agassiz, *Challenger* Reports, Zoology, vol. 3, pt. 9, Echinoidea, 1881, p. 40, pl. 3.—H. L. Clark, Bull. Mus. Comp. Zoöl., vol. 51, No. 7, 1907, p. 227.

Histocidaris elegans Th. Mortensen, The Danish *Ingolf*-Exped., vol. 4, pt. 1, Echinoidea, 1903, pp. 21, 30, 173.—H. L. Clark, Biol. Results Fishing Exper. F. I. S. *Endeavour*, 1909–1914, vol. 4, pt. 1, 1916, p. 105; Cat. Recent Sea-Urchins Brit. Mus., 1925, p. 37.

Localities.—Station 5446; eastern coast of Luzon; Atalaya Point, Batag Island, bearing S. 64° E., 5.3 miles distant (lat. 12° 43′ 51″ N., long. 124° 59′ 18″ E.); 540 meters; green mud; June 3, 1909 (1 specimen, Cat. Nos. E. 1307, E. 1308, U.S.N.M.).

Station 5450; eastern coast of Luzon; East Point, Batan Island, bearing S. 36° E., 9.2 miles distant (lat. 13° 23′ 15″ N., long. 124° 00′ 30″ E.); 734 meters; bottom temperature 5.72° C.; green mud and coral; June 4, 1909 (1 specimen, Cat. No. E. 1274, U.S.N.M.).

Station 5510; vicinity of northern Mindanao; Camp Overton Light bearing S. 68° E., 9.1 miles distant (lat. 8° 16′ 00″ N., long. 124° 03′ 50″ E.); 761 meters; bottom temperature 11.67° C.; gray mud and fine sand; August 7, 1909 (2 specimens, Cat. No. E. 1283, U.S.N.M.).

---

[1] Ech. Deutsche Tiefsee-Exped., pl. 13, fig. 4.

Station 5512, vicinity of northern Mindanao; Camp Overton Light bearing S. 76° E., 14 miles distant (lat. 8° 16′ 02″ N., long. 123° 58′ 26″ E.); 801 meters; bottom temperature 11.56° C.; gray mud and fine sand; August 7, 1909 (4 specimens, Cat. No. E. 1366, U.S.N.M.).

Station 5528; between Bohol and Siquijor; Balicasag Island (C.) bearing N. 15° E., 5.8 miles distant (lat. 9° 24′ 45″ N., long. 123° 39′ 15″ E.); 790 meters; bottom temperature 11.83° C.; globigerina ooze; August 11, 1909 (1 broken test, Cat. No. E. 1261, U.S.N.M.).

Station 5571; north of Tawi Tawi; Simaluc Island (N.) bearing S. 66° E., 5.8 miles distant (lat. 5° 30′ 45″ N., long. 120° 07′ 57″ E.); 612 meters; bottom temperature 11.28° C.; sand and shells; September 22, 1909 (3 specimens, Cat. No. E. 1385, U.S.N.M.).

Station 5618; Molucca Passage; March Island bearing S. 69° E., 7.8 miles distant (lat. 0° 37′ 00″ N., long. 127° 15′ 00″ E.); 750 meters; gray mud; November 27, 1909 (1 specimen, Cat. No. E.1296, U.S.N.M.).

Station 5656; Gulf of Boni, Celebes; Olang Point bearing N. 67° W., 14.5 miles distant (lat. 3° 17′ 40″ S., long. 120° 36′ 45″ E.); 871 meters; gray mud; December 19, 1909 (2 specimens, Cat. Nos. E.1260, E.1284, U.S.N.M.).

Remarks.—The specimens from station 5571 are too young to be identified with certainty, but in all probability they belong to this species; in any case they are young histocidarids.

The specimen from station 5618 with the horizontal diameter 38 mm. is a very typical *H. elegans*, its general shape and color and structure of the test and of the spines being in perfect agreement with specimens from the type locality, off Sydney, New South Wales. The pedicellariae are like those of the typical form. (Pl. 77, fig. 1.) In the specimen from station 5450, the pedicellariae are of a slightly different shape. (Pl. 77, fig. 3.) The specimens from stations 5512 and 5510 have the typical form of pedicellariae; the former are peculiar in being dark colored on the test and secondary spines; this may perhaps be due to their having been preserved together with crinoids, the pigment extracted from the crinoids having very often the result of giving specimens of various groups (echinoderms, corals, etc.), an unnatural dark color. Also the large broken specimen from station 5446 has the same dark color (and the same shape of pedicellariae). Concerning this latter specimen it is stated on the label "long spines, some of them yellow, others bleaching white; the short spines pale chrome yellow," so that here we have proof that the dark color is not natural and is due in some way to preservation.

The young specimens from station 5571 deserve special mention. The number of interambulacral plates is 5; only the upper tubercles are crenulate. The ambulacral plates on the upper part are 4 or 5 to each interambulacral plate, at the peristome only 1 or 2 to an interambulacral plate. The pores are half vertically placed. The peristome (fig. 6) is especially interesting; it is naked except for five large buccal plates, each with two pores for the buccal tube feet, and one or two ambulacral plates, just detached from the ambulacra. The large buccal plates are apparently simple, but on closer inspection are seen to be divided by a fine median line into two lateral halves; thus they were originally paired, as was to be expected. As yet there are no interambulacral plates on the peristome. It is important to notice that there is no trace of an unpaired primary interambulacral plate.

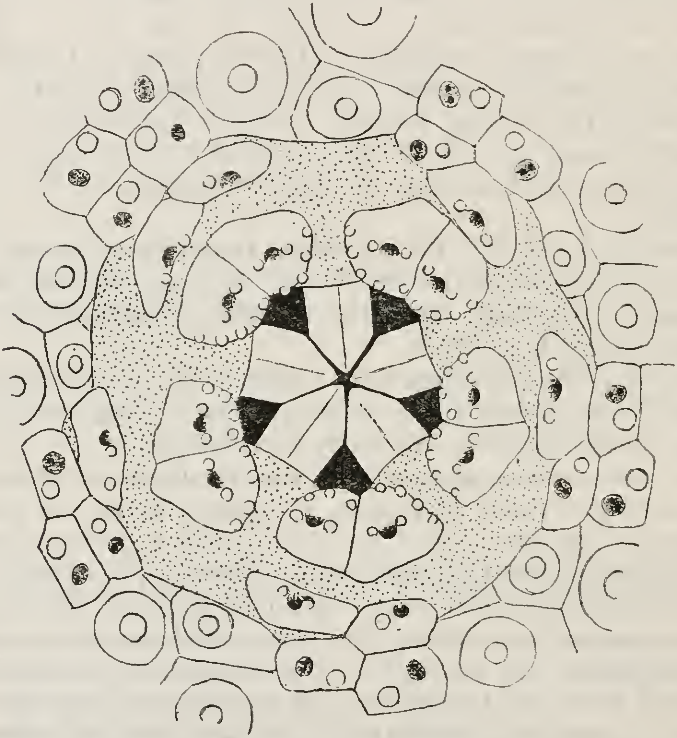


FIG. 6.—PERISTOME OF YOUNG SPECIMEN OF HISTOCIDARIS ELEGANS, OF 7 MM DIAMETER. ×20

The apical system (fig. 7.) is very simple, perfectly regular, with very few tubercles and, of course, still without genital pores. The longest spines are 27 mm. in length, nearly four times the diameter of the test. The first 1 or 2 oral primaries already have their typical strongly serrate form. The pedicellariae are still only of the smaller form.

The character of the apical system especially shows that the specimens described as "*Cidaris* (*Histocidaris*) *elegans*, juv.?" by de Meijere[2] can hardly belong to the same species as the young specimen here described. To which species they belong can not be determined at present; but it must also be kept in mind that the reference of the present small specimens to *H. elegans* is not beyond doubt either. H. L. Clark[3] points out that the pedicellariae of the *Siboga* specimens are peculiar; however, I find the pedicellariae in the young specimens from the *Albatross* collection very much like that figured by de Meijere, and also in larger specimens of undoubted *H. elegans* one may find small tridentate pedicellariae which are quite similar.

---

[2] *Siboga* Echinoidea, p. 25, pl. 2, fig. 17; pl. 12, figs. 136–140.

Genital pores are not yet developed in specimens of 14–16 mm. in horizontal diameter; but by the time they have reached a size of 24 mm. in horizontal diameter the pores have made appearance. The interradial plates of the peristome as a rule do not begin to appear until somewhat later, at a size of about 27 mm. horizontal diameter. In a specimen of 14 mm. horizontal diameter I find, however, one interradial plate on the peristome in one of the interradii, the others remaining naked.

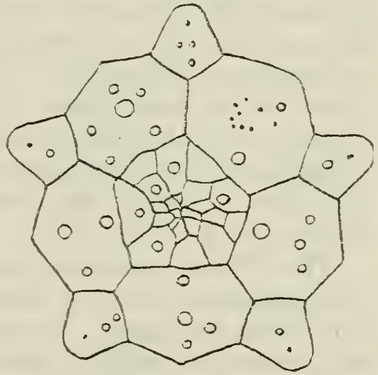


Fig. 7.—Apical system of young Histocidaris elegans, of 7 mm. diameter. ×11

One of the specimens from station 5656 is especially interesting. It is the largest of all, measuring 50 mm. in horizontal diameter, and is unusually high, 44 mm., being in fact quite egg shaped. (Pl. 52, fig. 1.) There are nine coronal plates. On several of the proximal ones the primary spine has been lost, and in its place a varying number of secondaries have developed. The specimen is a naked test, broken and in a poor state of preservation, but this is evidently not merely due to its having been roughly handled at the capture. Some of the areoles are perforated, which very probably means that the specimen was about to be devoured by some large gastropods at the moment when it came into the trawl. Nearly all the spines are lost, and most of the areoles are perfectly clean, which certainly can not be due to the rough treatment in the trawl. Apparently the specimen was already dead and had lost nearly all its spines when it was captured by the trawl. But it could only quite recently have died, as the intestine is still partly preserved and the peristomial membrane is still intact. Whether the specimen was killed by the mollusks or they only began to devour it after it was dead can not definitely be said, but the fact that most of the spines were already entirely lost, their muscles having completely disappeared, would rather indicate that the specimen had died of old age and then was about to be eaten by the gastropods.

---

[3] Bull. Mus. Comp. Zoöl., vol. 51, 1907, p. 227.

HISTOCIDARIS, species

Plate 51, figs. 1, 2; plate 77, figs. 5–8

Locality.—Station 5664; Macassar Strait; Kapoposang Light bearing N. 66° E., 3.8 miles distant (lat. 4° 43′ 22″ S., long. 118° 53′ 18″ E.); 731 meters; bottom temperature 6.28° C.; hard bottom; December 28, 1909 (1 specimen, Cat. No. E. 1278, U.S.N.M.).

Measurements

h. d.	v. d.	Apical system	Peristome	Number of—	
				I. a.	A. pro I. a.
23 mm	13 mm	11 mm. (47.8 per cent h.d.)	10 mm. (43.5 per cent h.d.)	7	7–8

Characters—The test is low, flattened above and below, with the sides arched. The ambulacra (pl. 51, fig. 1) are 2.5 mm. wide, and thus 22.7 per cent of the interambulacra, which are 11 mm. broad at the upper edge of the ambitus. The interporiferous zone is slightly wider than the poriferous zone. The series of marginal tubercles is very regular; the tubercles are rather small and not contiguous. The median area is entirely naked, with scarcely a single small tubercle. The pores are small, equal in size, and are separated by a distinctly elevated wall. (Fig. 4*b*.)

The primary interambulacral tubercles are distinctly crenulate. The areoles are not deep and are nearly circular, only the four lower ones being confluent. The median area is half as wide as an areole; the scrobicular ring of tubercles is rather prominent, the tubercles filling almost the whole space so that there is hardly room for a few small tubercles outside the scrobicular ring, and there is no naked sunken median line.

The apical system (fig. 8) is even more naked than usual in this genus. Each genital plate carries 2 or 3 tubercles at the genital pore and 2 or 3 rather large ones at the inner edge, the spines attached to the latter being rather stout and together with those of the anal system forming a dense cluster which closely covers the periproct. The genital pores are already developed, though rather small, which may mean either that it is a male specimen or that it is a female in which the pores have not yet reached their full size. Each ocular plate has 2 or 3 tubercles (spines); the ocular are all exsert.

The peristome is still without interambularcral plates.

The primary spines reach a length of at least 3 times the horizontal diameter, the exact length being uncertain, as the points are broken off. They are about 2 mm. wide at the base, and taper very slightly; whether the point itself is broadened can not be ascertained. They are provided with about 12 finely serrate longitudinal ridges, the surface between the ridges being distinctly furrowed. The upper primaries carry in their basal part 4 to 6 distant, larger spinules on the adapical side (though not very distinctly shown in the figures). The collar is short, 2–3 mm. in length. The oral primaries are of the usual form, slender, and not very conspicuous. In the present specimen only the three proximal ones have the shape of oral spines. The secondary spines are scarcely 4 mm. long, rather broad, flat, not excavated, often ending in three small points. (Pl. 77, fig. 8.) They are appressed toward the base of the primaries. Those of the ambulacra are about 3 mm. long, narrow, but flattened, and not setaceous.

The large tridentate pedicellariae are short, robust, with the head scarcely more than 2 mm. long. The valves (pl. 77, fig. 5) are broad, nearly triangular, with the blade filled with a close meshwork but with a shallow depression above the apophysis. The small tridentate pedicellariae (pl. 77, figs. 6–7) are shorter and broader than is usual in this genus, with some longer teeth at the point of the blade. The spicules of the tube feet are not characteristic, being of the usual form.

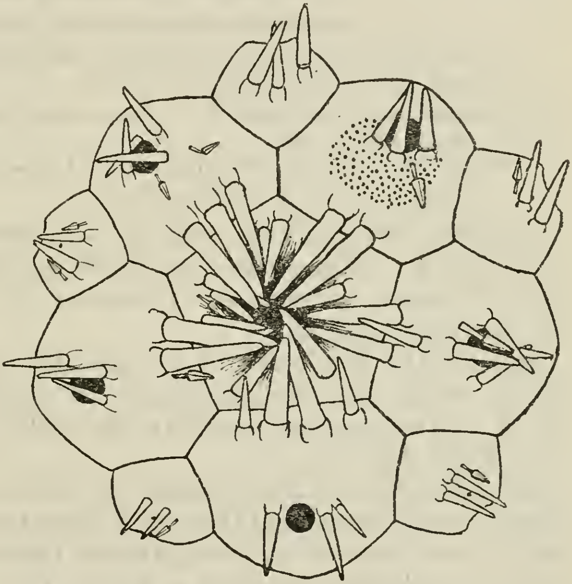


FIG. 8.—APICAL SYSTEM OF HISTOCIDARIS, SPECIES. ×6

The color of test and secondary spines is brown, the primary spines being white, excepting the collar, which is brownish, like the secondaries.

Remarks.—This specimen shows some resemblances to the form referred to by de Meijere,[4] to *Histocidaris misakiensis* (Yoshiwara). Especially the presence of some larger spinules on the adapical side at the base of the upper primary spines is a conspicuous point of resemblance. But in other regards, as in the very sparse tuberculation of the apical system, the shape of the secondary spines, and the pedicellariae, it differs so markedly from that form (which is otherwise entirely different from the true *H. misakiensis* of Yoshiwara, and will be described in the author's monograph of the Cidaridae under the name of *Histocidaris recurvata*) that it is out of the question simply to identify it with that species, for the present, at least. Very probably it represents a separate species, but on the basis of the single evidently young specimen at hand it would seem undesirable to establish a new species in this rather perplexing genus. I therefore prefer to leave it unidentified, merely calling attention to its characters and leaving the question of its specific status for future decision when more satisfactory material will be available.

---

[4] *Siboga* Echinoidea, p. 27, pl. 2, figs. 15, 16; pl. 12, figs. 141, 142.

Genus PRIONOCIDARIS A. Agassiz

PRIONOCIDARIS GLANDULOSA (de Meijere)

Cidaris (*Cidaris*) *glandulosa* DE MEIJERE, Die Echinoidea der *Siboga*-Exped., 1904, p. 13, pl. 1, figs. 5, 6.

Stephanocidaris glandulosa H. L. CLARK, Bull. Mus. Comp. Zoöl., vol. 51, No. 7, 1907, p. 194.

Prionocidaris glandulosa TH. MORTENSEN, Deutsche Südpolar-Exped., 1901–1903, vol. 11, pt. 1, 1909, pp. 51, 53.

Localities.—Station 5140; vicinity of Joló (Sulu); Joló Light bearing S. 33° W., 6.1 miles distant (lat. 6° 08′ 45″ N., long. 121° 03′ 00″ E.); 139 meters; fine coral sand; February 14, 1908 (1 specimen, Cat. No. E. 1276, U.S.N.M.).

Station 5442; west coast of Luzon; San Fernando Point Light bearing N. 39° E., 8.4 miles distant (lat. 16° 30′ 36″ N., long. 120° 11′ 06″ E.); 82 meters; coral sand; May 10, 1909 (1 specimen, Cat. No. E. 1370, U.S.N.M.).

Remarks.—The specimens agree very closely with the typical *glandulosa* except for the fact that not a single large globiferous pedicellaria is to be observed on them, while in the typical form these were found in such great numbers as to give the incentive for the name "*glandulosa*." It is, however, a well-known fact that the large globiferous pedicellariae especially are subject to great variation in their occurrence in cidarids, so that no stress at all can be laid on this peculiarity in the present specimens.

In the larger specimen, which is from station 5140 and measures 24 mm. in horizontal diameter, some of the primary spines are rather distinctly curved upward; in the smaller specimen this feature is hardly indicated. The oral primaries are distinctly "capped" in the larger specimen, less so in the smaller. The primaries of the larger specimen are partly covered with foreign organism (serpulids, barnacles, etc.). This specimen is also remarkable in its color, the denuded test showing some large violet-purple patches in the median interambulacral area. The interporiferous zone of the ambulacra is deep purple. In the smaller specimen, which is from station 5442 and measures 18 mm. in horizontal diameter, this color is much less pronounced.

An interesting abnormality is shown by the larger specimen, in that there are two genital pores in genital plate 3.

PRIONOCIDARIS BACULOSA, var. ANNULIFERA (Lamarck)

Plates 53, 54.

Cidaris annulifera de Loriol, Mém. soc. sci. nat. Neuchâtel, vol. 5, 1873, p. 25, pl. 3.

Leiocidaris pistillaris, var. *annulifera* Döderlein, Jenaische Denkschr., vol. 8, 1902, p. 692, pl. 59, figs. 1–5.

Cidaris (*Cidaris*) *baculosa* de Meijere, Die Echinoidea der *Siboga*-Exped. 1904, p. 9, pl. 2, figs. 9–12.

[Not *Phyllacanthus annulifera* A. Agassiz, Illustr. Cat. Mus. Comp. Zoöl., No. 7, pt. 3 (Mem. Mus. Comp. Zoöl., vol. 3), 1873, p. 387.]

Localities.—Station 5137; vinicity of Joló (Sulu); Joló Light bearing S. 61° E., 1.3 miles distant (lat. 6° 04′ 25″ N., long. 120° 58′ 30″ E.); 36 meters; sand and shells; February 14, 1908 (2 specimens, Cat. No. E. 1310, U.S.N.M.).

Station 5145; in the vicinity of Joló; Joló Light bearing S. 16° E., 0.85 mile distant (lat. 6° 04′ 30″ N., long. 120° 59′ 30″ E.); 42 meters; coral sand and shells; February 15, 1908 (2 small specimens, Cat. No. E. 1281, U.S.N.M.).

Station 5151; Tawi Tawi group, Joló Archipelago; Sirun Island (C.) bearing N. 58° E., 19.3 miles distant (lat. 5° 24′ 40″ N., long. 120° 27′ 15″ E.); 44 meters; coral sand and shells; February 18, 1908 (2 small specimens, Cat. No. E. 1279, U.S.N.M.).

Station 5160; Tawi Tawi group, Joló Archipelago; Tinakta Island (N.) bearing S. 72° W., 2.75 miles distant (lat. 5° 12′ 40″ N., long. 119° 55′ 10″ E.); 22 meters; sand; February 22, 1908 (1 young specimen, Cat. No. E. 1338, U.S.N.M.).

Station 5174; in the vicinity of Joló; Joló Light bearing E. 2.6 miles distant (lat. 6° 03′ 45″ N., long. 120° 57′ 00″ E.); 36 meters; coarse sand; March 5, 1908 (2 young specimens, Cat. No. E. 1381, U.S.N.M.).

Station 5355; North Balabac Strait; Balabac Light bearing S. 61° W., 16.6 miles distant (lat. 8° 08′ 10″ N., long. 117° 19′ 15″ E.); 80 meters; coral and sand; January 5, 1909 (1 young specimen, Cat. No. E. 1368, U.S.N.M.).

Station 5481; in the vicinity of Surigao Strait, between Samar and Leyte; Cabugan Grande Island (N.) bearing N. 86° W., 3.8 miles distant (lat. 10° 27′ 30″ N., long. 125° 17′ 10″E.); 111 meters; sand, shells, and gravel; July 30, 1909 (2 large and old specimens, Cat. No. E. 1340, U.S.N.M.).

Station 5482; in the vicinity of Surigao Strait; Cabugan Grande Island (N.) bearing N. 87° W., 4.5 miles distant (lat. 10° 27′ 30″ N., long. 125° 18′ 00″ E.); 122 meters; broken shells, sand, and green mud; July 30, 1909 (1 large specimen, Cat. Nos. E. 1311, E. 1312, U.S.N.M.).

Station 5641; Buton Strait; Kalono Point (W.) bearing N. 61° W., 3.4 miles distant (lat. 4° 29′ 24″ S., long. 122° 52′ 30″ E.); 71 meters; sand and shells; December 14, 1909 (4 specimens, Cat. No. E. 1270, U.S.N.M.).

Notes.—The material from station 5137 consists of two specimens with fusiform spinous primaries, and in addition a few detached spines. There are 2 young specimens from station 5145. From station 5151 there are 2 rather small specimens with fusiform spinous primaries, one of them with a parasitic gastropod (*Mucronalia*) at the edge of the peristome. The specimens from stations 5160, 5174, and 5355 are all young. The 2 specimens from station 5481 are large and old; the larger is 80 mm. in horizontal diameter, with cylindrical primary spines which are overgrown with barnacles and sponges. The specimen from station 5482 is large, with cylindrical primary spines. The 4 specimens from station 5641 partly have the primaries fusiform and strongly spinous at the base. (Pls. 53, 54.)

Remarks.—It is very tempting to distinguish as a separate variety the form which has the primary spines fusiform and strongly spinous in the basal portion (on the aboral side only), as its general appearance is very characteristic and very different indeed from that of the form with cylindrical spines. But so many transitional forms are met with and sometimes found together in the same locality (as for instance at station 5641) that no line of demarcation can be drawn between them, and we are thus forced to accept them as belonging within the variational range of the highly polymorphous variety *annulifera* of the highly polymorphous species *Prionocidaris baculosa*. The various forms are bound together by that eminently characteristic peculiarity, the red-spotted collar of the primary spines, which is otherwise nowhere met with among cidarids excepting, to some degree, in *Stylocidaris bracteata* (A. Agassiz).

PRIONOCIDARIS BISPINOSA (Lamarck)

Plate 52, fig. 3

Phyllacanthus annulifera A. Agassiz, Illustr. Cat. Mus. Comp. Zoöl., No. 7, pt. 3 [Mem. Mus. Comp. Zoöl., vol. 3], 1873, p. 387.

Rhabdocidaris bispinosa de Loriol, Mém. soc. sci. nat. Neuchâtel, vol. 5, 1873, p. 33, pl. 5.

Leiocidaris bispinosa Döderlein, Jenaische Denkschr., vol. 8, 1902, p. 695, pl. 58, figs. 5–11.

Cidaris (*Stephanocidaris*) *bispinosa* de Meijere, Die Echinoidea der *Siboga*-Exped., 1904, p. 4, pl. 1, fig. 4; pl. 2, fig. 14.

Prionocidaris bispinosa Döderlein Abhandl. Senckenb. naturf. Ges., vol. 34 1911, p. 240, pl. 9, figs. 1, 2.—Th. Mortensen, Kgl. Sv. Vet. Akad., Handl., vol. 58, 1918, p. 6, pl. 3, fig. 1.

[Not *Cidarites annulifera* LAMARCK, Hist. nat. des animaux sans vertèbres, vol. 2, 1816.

Not *Stephanocidaris bispinosa* A. AGASSIZ, Illustr. Cat. Mus. Comp. Zoöl. No. 7, part 1 (Mem. Mus. Comp. Zoöl., vol. 3), 1872, p. 160; pt. 3, 1873, p. 393.]

Localities.—Station 5144; in the vicinity of Joló (Sulu); Joló Light bearing S. 50° W., 3.4 miles distant (lat. 6° 05′ 00″ N., long. 121° 02′ 15″ E.); 35 meters; coral sand; February 15, 1908 (1 specimen, Cat. No. E. 1325, U.S.N.M.).

Station 5148; in the vicinity of Siasi, Joló (Sulu) Archipelago; Sirun Island (N.) bearing S. 80° W., 3.8 miles distant (lat. 5° 35′ 40″ N., long. 120° 47′ 30″ E.); 31 meters; coral sand; February 16, 1908 (2 specimens, Cat. No. E. 1343, U.S.N.M.).

Station 5149; in the vicinity of Siasi; Sirun Island (W.) bearing N. 39° E., 2.4 miles distant (lat. 5° 33′ 00″ N., long. 120° 42′ 10″ E.); 18 meters; coral and shells; February 18, 1908 (1 specimen, Cat. No. E. 1341, U.S.N.M.).

Station 5164; Tawi Tawi group, Joló Archipelago; Observation Island bearing S. 82° W., 8 miles distant (lat. 5° 01′ 40″ N., long. 119° 52′ 20″ E.); 33 meters; green mud; February 24, 1908 (1 specimen, Cat. Nos. E. 1269, E. 1287, U.S.N.M.).

Notes.—The specimens from stations 5148 and 5149 are large, and that from station 5164 is young; the specimen from station 5144 is referable to var. *chinensis* Döderlein.

Remarks.—The large specimens from stations 5148 and 5149 are very interesting in showing that this species reaches a much larger size than was hitherto known, up to 78 mm. in horizontal diameter. These specimens have evidently reached their full size and with their primaries overgrown with barnacles and other organisms, give the impression of being very old. It is noteworthy that both the apical system and the peristome of these specimens are relatively much smaller than in medium-sized examples. Thus the apical system is 37.1–37.7 per cent of the horizontal diameter, as against 43–50 per cent in medium-sized specimens, and the peristome is 28.2–29.2 per cent of the horizontal diameter, as against about 34–45 per cent in medium-sized examples. Evidently this signifies that the apical system and the peristome cease growing some time before the growth of the test ceases. In accordance with this, the number of peristomial plates is not greater in these old specimens than in those of medium size.

Some of the primaries in the old specimens are distinctly flattened in the outer part (pl. 52, fig. 3), just as is the case in large specimens of *Prionocidaris baculosa*, var. *annulifera*. Further, the large specimens have the interporiferous zone of the ambulacra thickly set with small tubercles, only one longitudinal series of smaller tubercles remaining distinct within the marginal series, while in smaller specimens in addition a second inner series of small tubercles is generally distinct.

Genus PLOCOCIDARIS Mortensen

PLOCOCIDARIS VERTICILLATA (Lamarck)

Phyllacanthus verticillata A. AGASSIZ, Illustr. Cat. Mus. Comp, Zoöl., No. 7, pt. 3 [Mem. Mus. Comp. Zoöl., vol. 3], 1873, p. 392, pl. 1*c*, figs. 40–42; pl. 1*f*, fig. 3.—DÖDERLEIN, Die japanischen Seeigel, I, Familien Cidaridae und Saleniidae, 1887, p. 22, pl. 9, figs. 8, *a–i*.—H. L. CLARK, Bull. Mus. Comp. Zoöl., vol. 51, No. 7, 1907, p. 187.

Plococidaris verticillata TH. MORTENSEN, Deutsche Südpolar-Exped. 1901–1903, vol. 11, pt. 1, 1909, pp. 50, 53.

Prionocidaris verticillata DÖDERLEIN, Abhandl. Senckenberg. naturf. Ges., vol. 34, 1911, pp. 242, 243.

Localities.—Station 5159; Tawi Tawi group, Joló (Sulu) Archipelago; Tinakta Island (N.) bearing N. 82° W., 1.4 miles distant (lat. 5° 11′ 50″ N., long. 119° 54′ 00″ E.); 18 meters; coral sand; February 21, 1908 (1 specimen, Cat. No. E. 1280, U.S.N.M.).

Tataan, Simulac Island; February 19, 1908 (1 specimen, Cat. No. E. 1289, U.S.N.M.).

Batan anchorage; June 22, 1909 (1 specimen, Cat. No. E. 1383, U.S.N.M.).

Genus EUCIDARIS Pomel

EUCIDARIS METULARIA (Lamarck)

Cidaris metularia H. L. CLARK, Bull. Mus. Comp. Zoöl., vol. 51, No. 7, 1907, p. 184.

Eucidaris metularia A. AGASSIZ and H. L. CLARK, Mem. Mus. Comp. Zoöl., vol. 34, No. 1, 1907, p. 5, pl. 1, figs. 3–7.—H. L. CLARK, Cat. Recent Sea-urchins Brit. Mus., 1925, p. 20.

Localities.—Station 5108; China Sea, off southern Luzon; Corregidor Light bearing N. 39° E., 22.5 miles distant (lat. 14° 05′ 05″ N., long. 120° 19′ 45″ E.); 23 meters; coral bottom; January 15, 1908 (5 specimens, Cat. No. E. 1371, U.S.N.M.).

Station 5249; Gulf of Dávao; Lanang Point bearing N., 1 mile distant (lat. 7° 06′ 06″ N., long. 125° 40′ 08″ E.); 41 meters; coral and sand; May 18, 1908 (1 specimen, Cat. No. E. 1369, U.S.N.M.).

Station 5257; eastern Illana Bay, southern Mindanao; Utara Point, Bongo Island, bearing N. 88° W., 7.7 miles distant (lat. 7° 22′ 12″ N., long. 124° 12′ 15″ E.); 50 meters; mud; May 22, 1908 (1 very young specimen, Cat. No. E. 1389, U.S.N.M.).

Philippines, with no further data (3 specimens, Cat. No. E. 1380, U.S.N.M.).

Genus GONIOCIDARIS L. Agassiz and Desor.

GONIOCIDARIS (DISCOCIDARIS) PELTATA, new species

Plates 55, 56; plate 74, figs. 4, 5; plate 78, figs. 9–12

Locality.—Station 5617; Dodinga Bay, Gillolo Island; Ternate Island (SE.) bearing S. 45° W., 7 miles distant (lat. 0° 49′ 30″ N., long. 127° 25′ 30″ E.); 239 meters; November 27, 1909 (1 specimen, the type, Cat. No. E. 1324, U.S.N.M.).

Measurements

h. d.	v. d.	Apical system	Peristome	Number of—		Longest spines
				I. a.	A. pro I. a.	
25 mm	15 mm	Ca. 12 mm. (c. 50 per cent h. d.)	11.5 mm. (46 per cent h. d.)	7–8	10–11	63 mm.

Description.—The test is rather high, flattened above, less flattened beneath. The sides are gently arched. The circumference is circular. The ambulacra are distinctly sinuate. The interporiferous zone is about twice the width of a pore zone. The marginal series of tubercles is very regular; the tubercles are not very conspicuous, but are very nearly contiguous; sometimes small miliary tubercles occur between adjoining tubercles. Within the marginal tubercules the plates are thickly set with very small miliaries, which are arranged more or less distinctly in transverse series. There is no distinct naked median vertical line; the horizontal sutures are deepened so as to form rather distinct grooves. The whole interporiferous area sinks slightly toward the middle line. The pores are somewhat sunken, the wall separating them being only slightly elevated. The ridge between the pore pairs is fairly high. (Pl. 74, figs. 4–5.)

In the interambulacra the areoles are fairly deep; only the two or three proximal ones are confluent. The scrobicular tubercles are slightly larger than the ambulacral marginal tubercles, half-moon shaped, and separated by small miliary tubercles. Alternating with the scrobicular tubercles there is a single tubercle about half their size outside the scrobicular ring, and the rest of the median part of the interambulacral plate is closely set with very small irregularly arranged miliary tubercles, which also occupy the midline, so as to leave only a vertical series of small slightly sunken grooves separated by miliary tubercles across the midline. The grooves formed by the horizontal sutures are very small and inconspicuous. On the adradial side of the plates there are also a few miliary tubercles outside the scrobicular ring. The median part of the interambulacra is only little more than half the width of a corresponding areole; it is scarcely sunken toward the middle line.

The apical system is about half the horizontal diameter of the test, and is not distinctly elevated and not thickened. The oculars are in part narrowly insert. Because of the danger of damaging the beautiful appearance of the specimen it was not determined whether all the oculars are insert; two of them certainly are, but a third apparently is not. For the same reason the serial number of these oculars could not be ascertained. The periproctal plates are apparently few and correspondingly large. The genital pores (male) are small, rather remote from the edge, and situated, on one of the plates at least, on a slight elevation. The plates of the apical system are rather closely covered with tubercles of various sizes. Especially there is a series of tubercles along the inner edge of the genital plates which are fairly large, bearing large flattened spines. The periproctal plates also each carry one or two similar tubercles and spines. (Fig. 9.)

The peristome is of about the same size as the apical system and is elevated somewhat in the form of a cone. There are about 8 ambulacral plates in a series. The ambulacra scarcely join at the mouth edge, thus leaving a rather free passage to the interradial plates, which number about 6 and are in a fairly regular series.

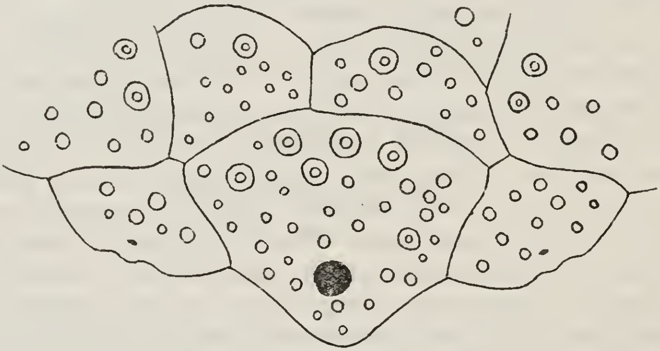


Fig. 9.—Part of apical system of Goniocidaris (Discocidaris) peltata, new species. ×8

The primary spines are of an extraordinary development, recalling those of *Goniocidaris* (*Discocidaris*) *mikado*. The basal disk is very well developed, forming a large entire plate, usually only on the adapical side; but sometimes it is also united across the adoral side of the spine; in such cases it is, however, much narrower on the adoral side. This disk may be repeated one or more times farther out along the shaft of the spine; there is thus formed a series of disks, such as is known in *D. mikado*. The second disk may be as complete as the first, but the following are only indicated by the spinules being more or less widened, while they are not wholly coalesced. Farther out the spinules are simple, and at the same time more numerous, but not arranged in regular series, and they gradually decrease in size toward the point of the spine, which may be broadened to a crown of various sizes, sometimes fairly large. The whole surface of the spine, with its disks and spinules, is covered by a close coating of rather long, coarse, not anastomosing, hairs. The spine as a whole tapers gently toward the point and is more or less distinctly curved downward. The collar is quite short; the milled ring is inconspicuous. The apical spines form rather large disks, of oval shape, with rather coarsely serrate edges. They are all eccentric, the adapical side being the larger on both inner and outer circle. The basal disk is scarcely indicated on these apical spines. The oral primaries are short, straight or nearly so, rather coarsely serrate along the sides and, excepting the first, also tuberculated on both the adoral and adapical sides; often they are somewhat widened at the point. The third is transitional to the ambital spines.

The scrobicular spines are about 2.5 mm. long, broad, flattened, slightly narrowing toward the straight cut end. They curve inward somewhat in their basal part, thus being slightly concave in side view; but they are otherwise flat, not concave on the outer side. The basal part is distinctly spiny. (Pl. 78, fig. 12.) The marginal ambulacral spines are somewhat shorter and narrower, with straight sides, not curved, but with spiny bases as in the scrobicular spines. Those near the peristome are rather distinctly broadened. The secondary spines are in general rather closely appressed. On the peristome the interradial spines are conspicuously smaller than those on the ambulacra. The miliary spines are very small and conical.

Large globiferous pedicellariae are found placed more or less regularly in the grooves of the interambulacra. They are of the usual globular shape, dark pigmented, and therefore the more conspicuous on the light test and among the much smaller miliary spines. The valves (pl. 78, fig. 9) are of the typical goniocidarid form, but with the blade prolonged more or less conspicuously into a narrow tube, which bears the opening on its end. The stalk is quite short, and without a limb. The small globiferous pedicellariae (pl. 78, figs. 10–11) are rather abundantly developed, with narrow compressed valves which may be more or less elongate, sometimes so much so as to resemble tridentate pedicellariae, especially as in the more elongated examples (head up to 0.3 or 0.4 mm.) the valves are not joined in the basal part. That they are, however, only a special development of the small globiferous type is evident from the transitional forms; in these most elongate forms also the end tooth may still be distinct. The large coarse form of tridentatelike pedicellariae so characteristic of several goniocidarids has not been observed.

The spicules of the tube feet are of the usual cidarid type.

The color of the primaries is pure white, as may be determined from one newly formed spine; in the others the white is more or less concealed by foreign organisms and also by particles of mud. The test and secondaries are a more grayish white. The naked test is white.

Another younger specimen with the apical disks not yet developed was dredged by the author at the Kei Islands in 1922.

Remarks.—This very fine species recalls through the character of its primary spines *Goniocidaris* (*Discocidaris*) *mikado*, from which it differs, however, very conspicuously in several important points, especially in its spiny secondaries and very small and slender miliary spines. It seems evident, however, that the two species are rather closely related. On the other hand, the present species would appear to have some relation also to the *Petalocidaris* group, with which it agrees in having the secondary spines spiny at the base and in the valves of the large globiferous pedicellariae being more or less distinctly prolonged into a narrow tube. It is hard to say which of the characters are of the greater significance. I would, however, be inclined to consider the character of the primary spines the more important, and therefore I refer this species to the subgenus *Discocidaris* together with Japanese species *mikado*.

CYRTOCIDARIS,[5] new subgenus

Characters.—This new subgenus of *Goniocidaris* is distinguished by its unusually long and slender pointed secondary spines, which are smooth and flattened. The primary spines are long and slender, rather strongly spinous, and more or less distinctly curved downward. The oral primaries are very smooth, distinctly curved, and in general rather conspicuous.

Genotype.—The type of this new subgenus is *Goniocidaris* (*Cyrtocidaris*) *tenuispina*, new species, described below.

Remarks.—It may be questioned whether it would not perhaps be preferable to make this species the type of a separate genus instead of merely a subgenus of *Goniocidaris*. But as in the great genus *Goniocidaris* the secondary spines vary rather widely it seems to me better to regard it only as a subgenus, even though the differences separating it from the other species of *Goniocidaris* are really rather striking.

GONIOCIDARIS (CYRTOCIDARIS) TENUISPINA, new species

Plate 57, figs. 1, 2; plate 58, fig. 1; plate 59, fig. 2; plate 61, figs. 6–8; plate 63, fig. 5; plate 73, figs. 5, 6; plate 79, figs. 1–3

Localities.—Station 5348; Palawan Passage; Point Tabonan bearing S. 89° E., 33.5 miles distant (lat. 10° 57′ 45″ N., long. 118° 38′ 15″ E.); 685 meters; bottom temperature 13.56° C.; coral sand; December 27, 1908 (1 specimen, Cat. No. E. 1384, U.S.N.M.).

---

[5] From κυρτός=curved.

Station 5423; Joló (Sulu) Sea; Cagayan Island, Cagayanes Islands (S.) bearing S. 11° E., 4.8 miles distant (lat. 9° 38′ 30″ N., long. 121° 11′ 00″ E.); 929 meters; bottom temperature 9.89° C.; gray mud and coral sand; March 31, 1909 (7 specimens, Cat. Nos. E. 1373, E. 1379, U.S.N.M.).

Station 5487; between Leyte and Mindanao; San Ricardo Point, Panaon Island, bearing S. 50° E., 11.2 miles distant (lat. 10° 02′ 45″ N., long. 125° 05′ 33″ E.); 1,338 meters; bottom temperature 11.28° C.; green mud; July 31, 1909 (1 specimen, the type, Cat. No. E. 1335, U.S.N.M.).

Station 5488; between Leyte and Mindanao; San Ricardo Point, Panaon Island, bearing S. 59° E., 9 miles distant (lat. 10° 00′ 00″ N., long. 125° 06′ 45″ E.); 1,411 meters; bottom temperature 11.28° C.; green mud; July 31, 1909 (4 specimens, Cat. No. E. 1344, U.S.N.M.).

Station 5510; in the vicinity of northern Mindanao; Camp Overton Light bearing S. 68° E., 9.1 miles distant (lat. 8° 16′ 00″ N., long. 124° 03′ 50″ E.); 757 meters; bottom temperature 11.67° C.; gray mud and fine sand; August 7, 1909 (1 specimen, Cat. No. 1386, U.S.N.M.).

Station 5511; in the vicinity of northern Mindanao; Camp Overton Light bearing S. 80° E., 15.3 miles distant (lat. 8° 15′ 20″ N., long. 123° 57′ 00″ N.); 749 meters; bottom temperature 11.67° C.; gray mud and sand; August 7, 1909 (5 specimens, Cat. No. E. 1346, U.S.N.M.).

Station 5512; in the vicinity of northern Mindanao; Camp Overton Light bearing S. 76° E., 14 miles distant (lat. 8° 16′ 02″ N., long. 123° 58′ 26″ E.); 813 meters; bottom temperature 11.56° C.; gray mud and fine sand; August 7, 1909 (22 specimens, Cat. Nos. E. 1318, E. 1372, U.S.N.M.).

Station 5527; between Bohol and Siquijor; Balicasag Island (C.) bearing N. 14° W., 8.2 miles distant (lat. 9° 22′ 30″ N., long. 123° 42′ 40″ E.); 716 meters; bottom temperature 11.83° C.; globigerina ooze; August 11, 1909 (6 specimens, Cat. No. E. 1345, U.S.N.M.).

Measurements

h. d.	v. d.	Apical system	Peristome	Number of—		Longest spines
				I. a.	A. pro I. a.	
22 mm.	12 mm.	12 mm. (54.5 per cent h. d.)	9 mm. (41 per cent h. d.)	7–8	9–11	58 mm.
20 mm.	11 mm.	10 mm. (50 per cent h. d.)	8 mm. (40 per cent h. d.)	7–8	8–10	ca. 45 mm.
19.5 mm.	11.5 mm.	10.5 mm. (53.8 per cent h. d.)	8 mm. (41 per cent h. d.)	7	10–11	ca. 45 mm.
18 mm.	11.5 mm.	10 mm. (55.5 per cent h. d.)	7 mm. (39 per cent h. d.)	7	9	ca. 50 mm.
17 mm.	12 mm.	9 mm. (53 per cent h. d.)	7 mm. (41 per cent h. d.)	7	8–9	ca. 55 mm.
12 mm.	8 mm.	6 mm. (50 per cent h. d.)	5 mm. (41.7 per cent h. d.)	6–7	7–8	ca. 45 mm.

Description.—The test is rather low, flattened both above and below, sometimes less so above where the apical system may be somewhat elevated so as to give the test a subconical appearance. The sides are more or less arched. The circumference is circular or subpentagonal.

The ambulacra are rather distinctly sinuate. The interporiferous zone is about twice the width of a pore zone. The marginal series of tubercles is very regular, the tubercles being small and inconspicuous and not nearly contiguous; there are usually some small miliary tubercles between each two consecutive marginal tubercles. Within the marginal tubercle each plate usually carries one smaller tubercle at the lower edge of the plate and often in addition one placed higher up and nearer the midline of the zone. When only the lower one of these tubercles is present, a fairly distinct vertical series is formed within the marginal series; when two inner tubercles are present the vertical arrangement is obscured. There is a rather conspicuous, naked, somewhat sunken middle part, and in general the ambulacra have a rather naked appearance. The horizontal grooves are fairly conspicuous, though merging into the sunken median part. The pores are equal sized, not sunken, separated by a rather narrow wall which rises into a fairly conspicuous tubercle; the ridge separating the adjoining pore pairs is low and inconspicuous. (Pl. 73, figs. 5–6.)

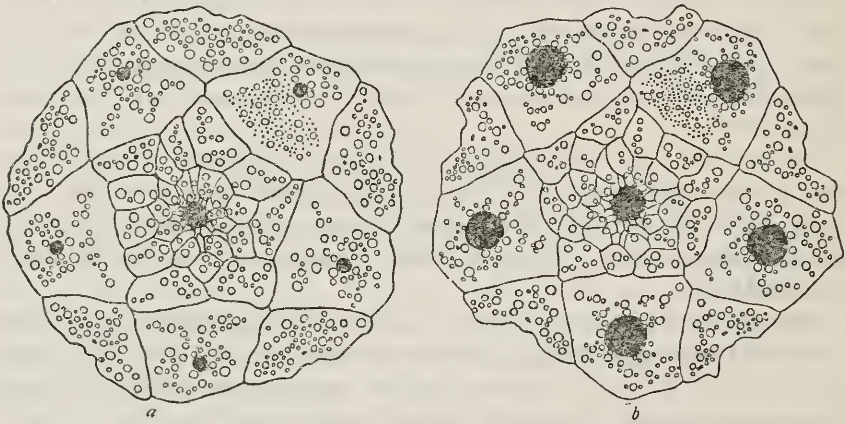


FIG. 10.—APICAL SYSTEM OF GONIOCIDARIS (CYRTOCIDARIS) TENUISPINA, NEW SPECIES. MALE (*a*) AND FEMALE (*b*). ×6

In the interambulacra the areoles are not very deep; the 3 or 4, rarely more, proximal ones are confluent; at most some of the small proximal ones are slightly transverse-oval. The scrobicular ring of tubercles is not very conspicuous; the tubercles, however, are distinctly larger than the marginal ambulacral tubercles. There is a rather broad, sunken, naked median part, leaving room for only a narrow belt of small tubercles outside the scrobicular ring. On the adradial edge of the plates there is barely room for a single series of small tubercles alternating with the scrobicular ones. The groove at the median end of the horizontal sutures is fairly conspicuous, merging into the sunken vertical median part; also at the adradial end of the sutures there is a rather distinct indication of a groove. The whole of the horizontal suture between the uppermost interambulacral plates may be more or less distinctly sunken. The median area of the interambulacra is scarcely two-thirds the width of an areole.

The apical system (fig. 10) is usually a little more than half of the horizontal diameter, rather thin, and not raised above the level of the test; it sometimes forms a slight rounded elevation, which may almost be termed subconical; more often the periproct alone is a little elevated, the genital and ocular plates remaining flat. The oculars are of a characteristic triangular form, with an acute apex inward, which often reaches the periproct, the oculars thus being generally, but not always, narrowly insert. The female genital pores are large and near the edge of the plates, the male pores being much smaller and about in the middle of the plates. The madreporite is not enlarged. The whole apical system is usually pentagonal in outline. The periproct is rather small. All the plates of the apical system are rather sparsely covered with small tubercles of uniform size; even those on the inner edge of the periproctal plates are not larger, corresponding to the fact that the secondary spines surrounding the anal opening are not larger than the other spines on the apical system, contrary to what is otherwise very generally the case in cidarids. A rather broad edge is left bare on the genital plates.

The genital pores are about to appear in a specimen 9 mm. in horizontal diameter.

The peristome is distinctly smaller than the apical system, somewhat irregularly pentagonal in outline. There are only 5 or 6 ambulacral plates in a series. The ambulacra do not join at the mouth edge, thus leaving a free though narrow passage for the interradial plates, which are more or less irregular, 2 to 4 in number. The peristomial plates in general are rather delicate.

The primary spines are long and slender, about three times the horizontal diameter, the ambital ones usually rather distinctly curved downward. They taper to a rather fine point. The basal disk is only indistinctly developed; usually there are only some larger spinules at the base which may be more or less flattened and broadened, so as to be united to some slight degree across the adapical side of the spine. But often these spinules are lacking, and then there is no trace of a basal disk. The shaft of the spine is otherwise set with rather sharp, outstanding spinules which are not curved outward, which show no regular serial arrangement, and which do not increase in size toward the point of the spine. The surface of the shaft is covered with a dense coat of fine anastomosing hairs which end in a long free point. (Fig. 11.) The collar quite short, increasing in thickness downward. The milled ring is very inconspicuous. The apical spines have a well-developed terminal disk which is usually deeply indented on the edge, sometimes very much so, then resembling a delicate flower (pl. 59, fig. 2); more rarely the edge is entire. The disk is more or less eccentric, the eccentricity being most developed on the adapical side. In some of the specimens both circles of disks—that is, the uppermost spine in each vertical series—have developed. Sometimes the shaft of these apical spines is fairly long, but in most cases it is short, as is generally the case in *Goniocidaris*. The basal disk is not developed in these apical spines. The oral primaries are long and slender, distinctly curved, and perfectly smooth, or more rarely with a faint indication of lateral serrations.

The scrobicular spines are about 3 mm. long, narrow and slender and ending in a rounded point; they are flattened and entirely smooth. The marginal ambulacral spines are about 2 mm. long, very slender, and scarcely flattened, those nearest the peristome being slightly broadened toward the point. The miliary spines are slender and pointed.

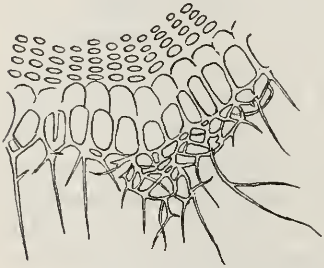


Fig. 11.—Part of transverse section of primary spine of Goniocidaris (Cyrtocidaris) tenuispina, new species. ×72

Large globiferous pedicellariae were not observed. The small globiferous pedicellariae are fairly numerous, and have slender compressed valves; the opening is narrow, more or less elongate, and slitlike; the end tooth is usually well developed. (Pl. 79, fig. 2–3.). A few large tridentate pedicellariae occur in some of the specimens. These are about 1.5 mm. in length of head, the stalk being much shorter. The valves are rather slender; they have the blade filled, as usual, with a coarse meshwork. (Pl. 79, fig. 1.) Although no transitional forms were found and no terminal slit is to be observed in the valves, there can be no doubt that these apparent tridentate pedicellariae are, as in other goniocidarids, only a special development of the small globiferous type. (Such transitional forms have been observed in the var. *tuberculata*.)

The spicules of the tube feet are of the usual form of irregular slightly spinous rods. The spicules of the intestine are of the triradiate type characteristic of goniocidarids.

The color of the test and of the secondaries is a yellowish white, the denuded test being entirely white. Only in the young specimen from station 5423 is there an indication of green on the apical system. The primaries usually are of a slight pinkish tint. The specimens from station 5512 are darker, but they give very much the appearance that this is due to preservation.

Notes.—The specimen from station 5348 is young, and its identification is not quite certain.

Some of the specimens from station 5512 are infested with a kind of parasitic organism that rests in small circular holes at the base of the oral primary spines. Within these holes there is a rather thick fibrillar sack containing a thick-walled globular cyst. Within the cyst an organism can be seen, but what kind of an organism it is I have been unable to ascertain.

GONIOCIDARIS (CYRTOCIDARIS) TENUISPINA, var. TUBERCULATA, new variety

Plate 57, fig. 3; plate 59, fig. 1; plate 61, figs. 9–11; plate 73, figs. 7–8; plate 79, figs. 4–8

Locality.—Station 5219; between Marinduque and Luzon; Mompog Island (NE.) bearing N. 35° 30′ W., 12.25 miles distant (lat. 13° 21′ 00″ N., long. 122° 18′ 45″ E.); 969 meters; bottom temperature 10.44° C.; green mud; April 23, 1908 (22 specimens, and some fragments, Cat. Nos. E. 1265, E. 1374, the type, U.S.N.M.).

Measurements

h. d.	v. d.	Apical system	Peristome	Number of—		Longest spines
				I.a.	A. pro I.a.	
21 mm	13 mm	10.5 mm. (50 per cent h.d.)	8 mm. (38 per cent h.d.)	8	11–12	
20 mm	12 mm	10 mm. (50 per cent h.d.)	7 mm. (35 per cent h.d.)	7	12–14	34 mm.
18 mm	11 mm	8.5 mm. (47.2 per cent h.d.)	6.5 mm. (36 per cent h.d.)	7–8	10-11	37 mm.
7 mm	10 mm	8.5 mm. (50 per cent h.d.)	6 mm. (35.3 per cent h.d.)	7–8	10–11	47 mm.
13 mm	7.5 mm	7 mm. (53.8 per cent h.d	5.5 mm. (42.3 per cent h.d.)	7	9–10	32 mm.
12 mm	7 mm	6 mm. (50 per cent h.d.)	5 mm. (41.7 per cent h.d.)	6–7	8–10	28 mm.

Characters.—From the typical form these specimens, and some others from the same locality, differ in the following characters:

The ambulacra are more closely tuberculated; inside the marginal tubercle each plate carries 2 or 3 tubercles, which are not much smaller than the marginal one and are usually arranged in a fairly distinct transverse series running obliquely upward toward the median line. There is no distinct naked sunken median line, the grooves formed by the horizontal sutures just connecting along the median line. The wall between the pores is flatter than in the typical form. (Pl. 73, figs 7–8.)

In the interambulacra the naked median line is narrowed, and correspondingly the number of tubercles on the median part of the plates is rather conspicuously larger; the upper interambulacral plates in general are more closely tuberculated than in the typical form.

The most conspicuous difference, however, is found in the apical system, which is much more closely tuberculated than in the typical form; the shape of the oculars also is quite different. (Fig. 12, to compare with fig. 10.)

The primary spines are scarcely so long as in the typical form, generally not more than about twice the horizontal diameter, but otherwise they are not appreciably different; the secondary spines do not differ from those of the type.

In the pedicellariae no difference is found in the globiferous form, but the "tridentate" form is, as a rule, somewhat shorter and broader than in the type. (Pl. 79, figs. 7–8.) All transitional forms are found between the tridentate and the usual small globiferous type (pl. 79, figs. 4–6), so that no doubt can exist about the apparent tridentate being only transformed globiferous and not true tridentate pedicellariae. They may reach a size of about 1.2 mm. in length of head; the stalk is very short.

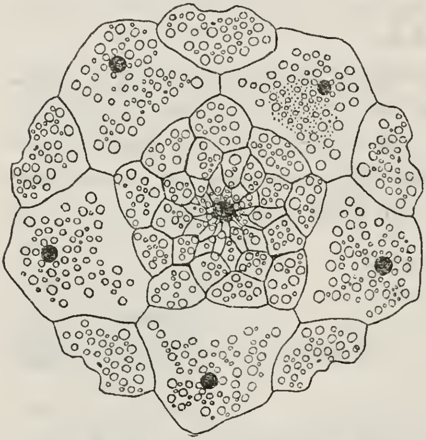


FIG. 12.—APICAL SYSTEM OF GONIOCIDARIS (CYRTOCIDARIS) TENUISPINA, NEW SPECIES, VAR. TUBERCULATA, NEW VARIETY. ×6

In regard to the color it is noteworthy that the primary spines are white, not of the pinkish tint usual in the typical form.

Notes.—Some broken specimens were found to contain mud with Foraminifera in their intestine. Some of them have an ophiuran (*Ophiacantha*, species) clinging to their spines. One specimen is abnormal in having two genital pores in genital 5. (Pl. 61, fig. 11.)

Remarks.—It is evident that this form can not simply be identified with *Goniocidaris* (*Cyrtocidaris*) *tenuispina;* the shape of the oculars, the closer tuberculation of the apical system and of the ambulacra and interambulacra especially are fairly conspicuous differences. Possibly it ought to be regarded as a separate species. The differences are, however, not quite constant, as in the typical forms the oculars sometimes have very nearly the same form, and it would, therefore, seem the best course, for the present, to designate it only as a separate variety.

GONIOCIDARIS (CYRTOCIDARIS) TENUISPINA, var. MAJOR, new variety

Plate 58, fig. 2; plate 79, fig. 9

Locality.—Station 5259; off northwestern Panay; Caluya Island (S.) bearing S. 73° W., 12 miles distant (lat. 11° 57′ 30″ N., long.

121° 42′ 15″ E.); 570 meters; bottom temperature 9.61° C.; gray mud and globigerina ooze; June 3, 1908 (1 specimen, the type, Cat. No. E. 1351, U.S.N.M.).

Measurements

h. d.	v. d.	Apical system	Peristome	Number of—		Longest spines
				I. a.	A. pro I. a.	
29 mm.	18 mm.	14 mm. (48.8 per cent h. d.)	9 mm. (31 per cent h. d.)	8–9	12–13	55 mm.

Characters.—This specimen differs in certain respects both from the typical form and from the variety *tuberculata*.

In the first place its larger size is noteworthy, 29 mm. in horizontal diameter as against at most 22 mm. in the typical form. This does not simply mean that it is older and therefore larger. It must be kept in mind that the species of *Goniocidaris* develop the apical disks only on the uppermost spine in each series of primaries, and accordingly, when the disks have been formed, the specimens must be assumed to have reached their full size. The specimen of the typical form in which the apical disks have appeared in all the series, not only in one series in each interambulacrum, measures only 22 mm. in horizontal diameter; but the specimen from station 5259 measures 29 mm. in horizontal diameter and has still only developed the first circle of the disks and thus evidently has not yet reached its maximum size. Then the primary spines are distinctly thicker than those of the typical form, 2.5 mm. in diameter at the base, against 1.5–1.8 mm. Also the spinules of the primaries are distinctly smaller than in the typical form; further, the fact that the spinules are distinctly larger in the outer part of the spine is a conspicuous difference from the type. The hair covering is somewhat denser but otherwise essentially like that of the type.

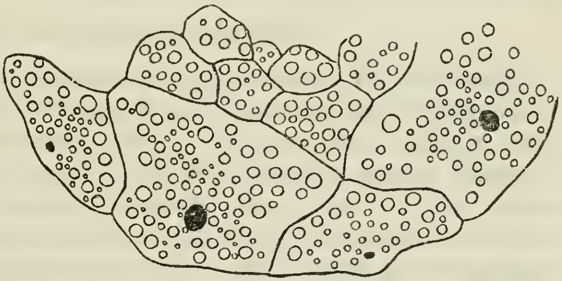


Fig. 13.—Part of apical system of Goniocidaris (Cyrtocidaris) tenuispina, new species, var. major, new variety. ×6

In regard to the test and the secondary spines I hardly find any noteworthy differences from the typical form; but the oculars are more elegant in outline and not triangular (fig. 13 to compare with fig. 10), and the scrobicular tubercles are slightly larger. The pedicellariae are as in the type; but an example of the large globiferous form was also found in this specimen. It is of considerable interest in having the valves somewhat prolonged into a narrow tube, on the end of which the opening is situated (pl. 79, fig. 9). This recalls the form of large globiferous pedicellaria found in "*Petalocidaris*" and shows that this character is scarcely of generic value, the present form being otherwise in no way nearly related to the *Petalocidaris* group. The color is the same as in the typical form.

Remarks.—It does not seem justifiable simply to identify this specimen with the typical form, or with the variety *tuberculata* as described above. On the other hand the differences are not very important, so that it would not seem warranted to make this specimen the type of a separate species. So long as only this single specimen is available the proper course seems to be to designate it as a variety, var. *major*, of *Goniocidaris* (*Cyrtocidaris*) *tenuispina*.

RHOPALOCIDARIS, new genus[6]

Diagnosis.—A genus of Goniocidaridae with small but distinct grooves at the median end of the horizontal sutures, and with a broad, bare, sunken median space in both ambulacra and interambulacra Primary spines without basal disk; apical primaries simple or, at most, with a very small terminal widening. Surface of primary spines covered with a well-developed coat of fine, not branching or anastomosing hairs. The primaries otherwise with rather coarse longitudinal ridges and furrows, more or less strongly spinous. Secondary spines club shaped, not appressed. Globiferous pedicellariae, both the large and small form, of the typical goniocidarid structure. Very small forms.

Genotype.—*Cidaris* (*Discocidaris*) *hirsutispinus* de Meijere.

Remarks.—It has been maintained by H. L. Clark[7] that this species is only the young of *Goniocidaris clypeata*. The study of adult specimens, collected partly by the *Albatross*, partly by the author during the Danish expedition to the Kei Islands in 1922, and the comparison with the type specimen from the *Siboga* expedition, kindly lent me by Prof. L. F. de Beaufort, the director of the Amsterdam Museum, does not leave the slightest doubt that *hirsutispinus* is a well-characterized species, and so far from being identical with *G. clypeata*: it can not even be referred to the same genus, but must form the type of a new genus. The main character distinguishing this genus from the rest of the goniocidarids is the peculiar club-like shape of the secondary spines. Only in *Goniocidaris umbraculum* is there an indication of a similar club-like shape of the secondary spines, especially the small miliary spines; still in this case it is rather different from what obtains in *Rhopalocidaris;* and besides, *G. umbraculum* has at least the apical disks well developed. On the whole I think *Rhopalocidaris* a very well delimited genus, the more so as all the species (I have two other species of the same genus from Japan) agree in the characters pointed out as distinguishing the genus.

---

[6] From ῥόπαλον=club.

[7] The Cidaridae, p. 197.

RHOPALOCIDARIS HIRSUTISPINA, var. VIRIDIS, new variety

Plate 61, fig. 2; plate 73, figs. 1, 2; plate 78, figs. 6–8

Locality.—Station 5543; in the vicinity of northern Mindanao; Tagolo Light bearing S. 75° W., 12.5 miles distant (lat. 8° 47′ 15″ N., long. 123° 35′ 00″ E.); 296 meters; bottom temperature 12.50° C.; sand; August 20, 1909 (1 specimen, the type, Cat. No. E. 1382, U.S.N.M.).

Measurements

h. d.	v. d.	Apical system	Peristome	Number of—		Longest spines
				I. a.	A. pro I. a.	
15 mm	10 mm	8 mm. (53.3 per cent h. d.)	7 mm. (46.6 per cent h. d.)	8	5 (6)	15 mm.

Description.—The test is rather high, flattened above but not below; the sides are gently arched. The circumference is circular. The ambulacra are scarcely at all sinuate. The interporiferous zone is about twice the width of a pore zone. The marginal ambulacral series of tubercles is quite regular; the tubercles are rather small, but with a comparatively large, very distinct mamelon; they are not contiguous, and generally there is a small miliary tubercle between each two successive tubercles. Within the marginal tubercle there is another almost equally large tubercle at the lower edge of the plate, these inner tubercles thus alternating with the marginal ones. They do not, however, occur regularly, some plates here and there having only the marginal tubercle. The plates are otherwise entirely naked and sunken, thus forming a very conspicuous sunken median area, sharply delimited from the tuberculated part which forms like an elevated ridge, being also rather sharply delimited from the poriferous zone. The pores are equal sized, separated by a fairly broad and somewhat elevated wall; the ridge between the pore pairs is rather low. The whole pore zone is somewhat sunken. (Pl. 73, figs. 1–2.)

In the interambulacra the areoles are small, circular, even the lowermost ones being scarcely at all transverse-oval; the 4 or 5 proximal ones are confluent. The mamelon is relatively very large, the areole correspondingly narrow and not very deep. The scrobicular ring is rather inconspicuous; the scrobicular tubercles are not larger than the marginal ambulacral tubercles; there are only about 12 of them on the upper plates. Outside the scrobicular tubercles there is another circle of tubercles of about the same size, alternating with the former, and on the median part of the plate still 2 or 3 tubercles medially to the second circle and alternating with them; these last-mentioned tubercles are of the same size as the others. A broad median portion of the plates is left bare and sunken, slightly deepest at the horizontal sutures, representing the usual grooves. At the adradial end of the sutures there is a slight indication of a groove. The median area is about one and one-half times as broad as an areole.

The apical system (fig. 14) is slightly more than half the horizontal diameter of the test. It is flat, scarcely raised around the anal opening. The ocular plates are widely exsert; the line of junction of the genital plates is rather conspicuously sunken, the genital plates thus being somewhat elevated in the middle. The genital pores (female) are large, nearly 1 mm. in diameter, rather distant from the edge. The periproct is small, with few plates. The whole of the apical system is uniformly, but not very closely, covered with small tubercles of almost equal size; the spines of the apical system also are of almost equal size all over. The tubercles (and spines) are a little more dense around the genital opening.

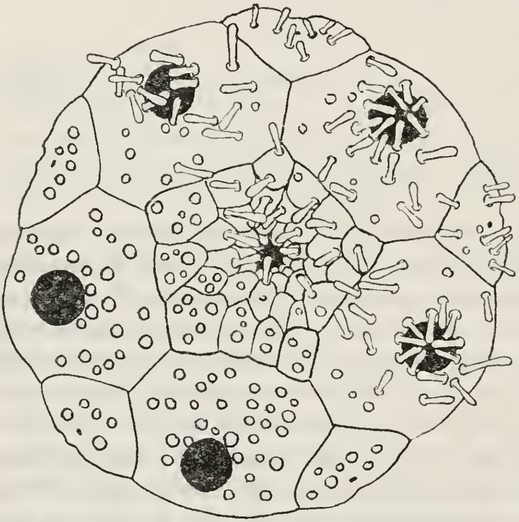


Fig. 14.—Apical system of Rhopalocidaris hirsutispina (de Meijere), var. viridis, new variety. ×8

The peristome is somewhat smaller than the apical system, and is slightly raised in the form of a cone. There are 8 or 9 ambulacral plates in a series; the ambulacra join at the mouth edge. The interradial plates are 3 or 4 in number.

The primary spines are only as long as the horizontal diameter of the test. They are comparatively coarse and thick, about 1.5 mm. in diameter, tapering only very slightly and ending in a simple rounded point. In the proximal part they are provided with outstanding, fairly large spinules, arranged quite irregularly, between which the surface is covered with rather coarse, unbranched, not anastomosing hairs (pl. 78, figs. 8, *a*, *b*); some of the hairs may be thickened, forming a transition to the spinules. The outer half, or a little more, of the spine is without hairs or spinules, rather coarsely furrowed, the ridges being more or less irregular, the surface of the spine thus acquiring a more or less distinctly meandric aspect. The apical spines are not different from the ambital ones. The oral primaries are short, almost straight, with rather coarsely serrate edges. The fourth is transitional to the ambital primaries.

The secondary spines are all distinctly club-shaped, with finely serrate ridges. (Pl. 78, fig. 6.) They are about 1 mm. long and are rather erect.

Only the small globiferous form of pedicellariae is present; these are very inconspicuous, scarcely exceeding 0.2 mm. in length of head, the stalk being up to 0.5 mm. long. The valves (pl. 78, fig. 7) are rather slender, though not compressed, with a relatively large opening and a strong end tooth. The spicules are coarsely spiny, somewhat larger than usual, but otherwise of the typical cidarid form.

In color the apical system is distinctly greenish, the green color continuing some way over the test. The primaries are pinkish in the basal part, this color gradually paling outwardly so that the points are white.

Remarks.—That this specimen is nearly related to *hirsutispina* (de Meijere) is beyond doubt. It differs, however, from that species in some features, for instance in the conspicuous green color (*hirsutispina* is not at all green), in having the primary tubercles larger, and in addition in some minor points in the apical system and in the ambulacra. It is evident that these differences forbid simply identifying the present form with *hirsutispina*. The question is only whether it should be regarded as a separate species or only as a variety of *hirsutispina*. With the scanty material at present available (only one adult specimen of *hirsutispina*, besides the type specimen which is not yet adult) it is impossible to reach a definite solution of the question, as it is impossible to judge of the constancy of the characters pointed out. I am rather inclined to think that the form from the Philippines will prove to be a separate species, but for the present it may suffice to designate it only as a variety of *hirsutispina*.

Genus SCHIZOCIDARIS Mortensen

Diagnosis.—A genus of Goniocidaridae with small but distinct grooves at the median end of the horizontal sutures. Primary spines without a basal disk; the apical primaries simple, not with the point widened into a disk. Surface of primary spines covered with a coat of fine hairs, widened at the top into large fenestrated plates, which coalesce so as to form a complete closed roof all over the spine, rest-ing on the basal part of the hairs as upon columns. The surface of the primaries thus apparently smooth and shining. Secondary spines flattened, smooth. Small globiferous pedicellariae of the usual goniocidarid type, with a large end tooth. Large globiferous pedicellariae unknown.

Genotype.—*Schizocidaris assimilis* Mortensen.

Remarks.—This genus, which was established by the author in the *Ingolf* Echinoidea[8] was based on the peculiar character of the pedicellariae; it was rejected by Döderlein and H. L. Clark, these authors maintaining that the single character of the pedicellariae alone can not justify the establishment of a separate genus. With this argument I quite agree; nevertheless *Schizocidaris* is a perfectly valid genus. The study of the rich material of *S. assimilis* which I collected at the Kei Islands during the Danish expedition in 1922, together with that collected by the *Albatross*, has shown that, while the character of the pedicellariae appears not to hold good for the other species, other much more valuable characters are found which distinguish this group of species from all other goniocidarids, especially the peculiar structure of the primary spines.

The type of this genus is the species which I named *Schizocidaris assimilis*, found by the *Challenger* at the Kei Islands (station 192) and referred by A. Agassiz to *Goniocidaris florigera*. To the same genus belongs the species which I designated[9] as *Discocidaris* (?) *serrata*, not having then observed its close affinity to *S. assimilis*. The species *serrata*, which was taken by the *Challenger* in the Philippine Sea between Mindoro and Luzon (station 204) and likewise referred by A. Agassiz to *Goniocidaris florigera*, was rediscovered by the *Albatross*. Another species, *fasciata*, new species, was also found by the *Albatross* in the Philippines, so that we now know three distinct species of the genus *Schizocidaris*.

SCHIZOCIDARIS SERRATA (Mortensen)

Plate 61, fig. 1; plate 74, figs. 1, 2; plate 78, fig. 1

Goniocidaris florigera (part) A. Agassiz *Challenger* Reports, Zoology, vol. 3, pt. 9, Echinoidea, 1881, p. 46, pl. 1, figs. 7–11.

Discocidaris (?) *serrata* Mortensen, The Danish *Ingolf*-Exped., vol. 4, pt. 1, Echinoidea, 1903, pp. 25, 29, pl. 10, figs. 6, 7.

Locality.—Station 5415; between Cebu and Bohol; Lauis Point Light bearing N. 24° W., 7.2 miles distant (lat. 10° 07′ 50″ N., long. 123° 57′ 00″ E.); 161 meters; bottom temperature 16.89° C.; fine sand; March 24, 1909 (1 specimen, Cat. No. E. 1375, U.S.N.M.).

---

[8] Part 1, pp. 25, 28, 1903.

[9] *Ingolf* Echinoidea, pt. 1, pp. 25, 29.

Measurements

h. d.	v. d.	Apical system	Peristome	Number of—		Longest spines
				I. a.	A. pro I. a.	
20 mm.	13 mm.	10 mm. (50 per cent h. d.)	8 mm. (40 per cent h. d.)	8	8–9	34 mm.
18 mm.	11 mm.	10 mm. (55 per cent h. d.)	7.5 mm. (41.7 per cent h. d.)	8–9	9–10	25 mm.

NOTE.—The larger of the specimens measured is from *Challenger* station 204, the smaller from *Albatross* station 5415.

Description.—The test is flattened above and below, with the sides beautifully arched; the circumference is circular. The ambulacra are very little sinuate. The interporiferous zone is about twice the width of a pore zone. The marginal series of tubercles is very regular, the tubercles being small and not contiguous. Within the marginal tubercle each plate carries a number of small tubercles which are not regularly arranged, covering the whole plate and leaving only the horizontal edges free, which are sunk so as to form distinct grooves, narrowly connected through the likewise sunken vertical suture. The whole interporiferous zone is otherwise flat, scarcely at all sloping toward the midline of the area. The pores are rather small, equal sized, and rather distant, being separated by a fairly broad wall which rises into a low rounded tubercle. The ridge separating the adjoining pore pairs is low. The whole pore zone is scarcely at all sunken (pl. 74, figs. 1–2).

In the interambulacra the areoles are rather low, the subambital slightly transverse-oval; the three or four proximal ones are confluent. The horizontal suture between the uppermost plates is more or less deepened. The scrobicular ring is inconspicuous, with the tubercles not much larger than the marginal ambulacral tubercles. The median part of the plates is closely covered with small tubercles which are rather distinctly arranged in horizontal series. The inner end of the horizontal sutures are deepened so as to form a fairly conspicuous groove; the adradial end of the sutures also shows an indication of a groove. The vertical median suture is narrowly naked and slightly sunken, the whole median interambulacral area sloping gently toward the median line. The width of the median area is about two-thirds of an areole.

The apical system is from 50 to 55 per cent of the horizontal diameter, slightly raised in the middle, but not thickened so as to rise with its edges above the level of the test as is the case in some other goniocidarids, for instance, *Discocidaris mikado*. The oculars are widely exsert in the *Albatross* specimen, while in the specimen from *Challenger* station 204 they are all insert. The genital pores are rather distant from the edge. The periproctal plates are few, and the whole periproct is small. All the apical plates are closely covered by tubercles of uniform size (fig. 15).

The peristome is markedly smaller than the apical system, only from 40 to 41.7 per cent of the horizontal diameter as against from 50 to 55 per cent of the horizontal diameter, and quite flat. There are eight or nine ambulacral plates in a series. The ambulacra do not quite join at the mouth edge; there are three or four interradial plates in a series.

The ambital spines are about one and one-half times the horizontal diameter (it appears that the point is broken in most of those of the *Albatross* specimen). They are slightly fusiform at the base, more so in the *Challenger* specimens, then taper very gently to a rather fine point. They are beset more or less closely with anteriorly directed but usually almost straight spinules, two lateral series of which may be somewhat more conspicuous than the rest; but generally an arrangement of the spinules in longitudinal series is very indistinct. In general the spinules are in the main confined to the adapical side of the spine; more rarely they are also well developed on the adoral side. The point of the spines is not widened into a small crown. The surface of the spines is apparently quite smooth and shining; in reality it is covered by a coat of hairs, which anastomose at their ends so as to form a complete, closed, very finely fenestrated roof, which rests upon the basal part of the hairs as upon columns (figs. 16, *a–c*). The apical spines are not different from the ambital, merely somewhat shorter. The oral primaries are slender, smooth, merely

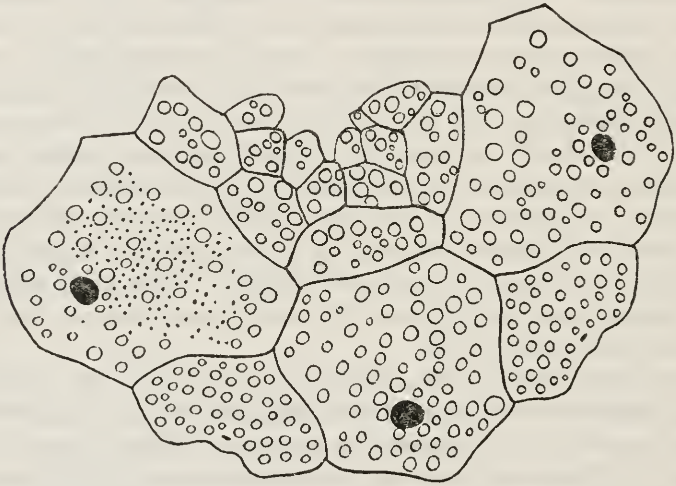


Fig. 15.—Part of apical system of Schizocidaris serrata (Mortensen). ×8

with some lateral serrations which are not very conspicuous; they are straight or at most very slightly curved. The fourth is transitional to the ambital spines.

The scrobicular spines are about 2 mm. long, smooth, thin, and flat, or with a slight indication of being excavated toward the end, which is straight cut; the sides are very nearly parallel. The marginal ambulacral spines are of the same general shape, but more narrow and more slender; they may be slightly widened toward the point; those near the peristome are scarcely different from the ambital, as is the case in some goniocidarids. The miliary spines are slender, conical, with finely serrate ridges.

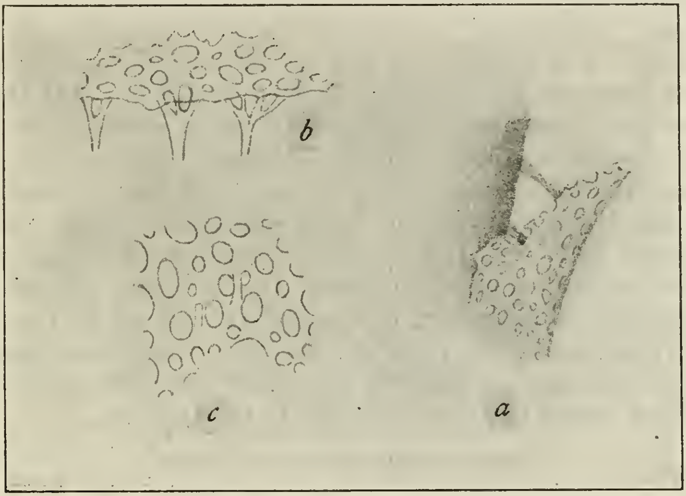


FIG. 16.—DETAILS OF HAIR-COVERING OF PRIMARY SPINES OF SCHIZOCIDARIS SERRATA MORTENSEN. *a*. PART OF SPINULE WITH THE FENESTRATED OUTER LAYER FORMED BY THE HAIRS; TWO COLUMNS ARE SEEN TO CONNECT THE OUTER LAYER WITH THE COMPACT MASS OF THE SPINULE. *b*. PART OF THE OUTER LAYER, HALF IN PROFILE, SHOWING THREE SUPPORTING COLUMNS. *c*. PART OF THE OUTER LAYER, SEEN FROM THE INSIDE. ×120

Only the small globiferous form of pedicellariae is found, and these are not very numerous or very conspicuous, scarcely exceeding a size of 0.2 mm. in length of head, while the stalk may be as much as 0.6–0.7 mm. The valves (pl. 78, fig. 1) are of the usual goniocidarid type, with a conspicuous end tooth; the opening is rather unusually short; the form with the long, narrow slitlike opening so characteristic of *S. assimilis* has not been found in this species.

The spicules of tube feet are very numerous, slender, and more spiny than in *S. assimilis*.

In color the primary spines are white (when clean), the test and secondaries yellowish white. The apical system is greenish, the green color being in the main confined to the genital plates and to the inner periproctal plates, but continuing a little way on to the interambulacra, where the green is located mainly at the upper and lower edge of the areoles. The ocular plates and the ambulacra are white. A very conspicuous feature of the *Albatross* specimen is the dark brownish color of the tube feet, which makes them appear as very distinct radiating lines, especially on the peristome and the oral side of the test. In the *Challenger* specimen this coloration is much less conspicuous, probably faded; in one of those in the British Museum it is, however, quite distinct.

Occurrence.—The only other locality from which the species is known, is lat. 12° 43′ N., long. 122° 10′ E., 100–115 fathoms (*Challenger* station 204), very close to the place where it was found by the *Albatross*.

Remarks.—It is evident that this species is very closely related to *assimilis* from the Kei Islands. In fact, were it not that the pedicellariae are so conspicuously different, I would consider them to be one and the same species, the other differences, the less strongly spiny primaries, the much more closely tuberculated interporiferous zone of the ambulacra, and the color, being scarcely more than might well be supposed to be within the range of variation of a single species. However, judging from the material available, the differences are real, and quite conspicuous; it is, therefore, at least for the present necessary to regard them as distinct species. Should they ultimately prove to be identical (which I do not expect they will) the name *serrata*, as the first of the two, is the one to be retained.

SCHIZOCIDARIS FASCIATA, new species

Plate 61, fig. 3; plate 74, fig. 3; plate 78, fig. 2

Locality.—Station 5547; near Joló (Sulu); Noble Point, Tulayan Island (E.) bearing S. 38° E., 9.5 miles distant (lat. 6° 09′ 20″ N., long. 121° 13′ 40″ E.); 283 meters; bottom temperature 13.50° C.; fine sand; September 15, 1909 (1 specimen, the type, Cat. No. E. 1387, U.S.N.M.).

Measurements

h. d.	v. d.	Apical system	Peristome	Number of—		Longest spines
				I. a.	A. pro I. a.	
8 mm.	4 mm.	4 mm. (50 per cent h. d.)	4 mm. (50 per cent h. d.)	6–7	5–6	15 mm.

Description.—The test is low, flattened above and below, with the sides arched; the circumference is circular.

The ambulacra are nearly straight. The interporiferous zone is about twice the width of the pore zone. The marginal series of tubercles is regular, the tubercles rather small, not contiguous. Within the marginal tubercle each plate carries a small tubercle at the lower edge, the rest of the plate being smooth and rather sunken. The horizontal sutures are slightly deepened, but it can not be said that the grooves are distinct; rather they go together with the whole of the sunken median part. In places there is a small tubercle between the marginal tubercles. The pores are small, equal sized, separated only by a narrow wall which is scarcely raised. The ridge between the adjoining pore pairs is rather low (pl. 74, fig. 3).

In the interambulacra the areoles not very deep, the 3 or 4 proximal ones confluent; only the lowermost are slightly transverse-oval. The scrobicular ring is not very conspicuous, the tubercles being scarcely larger than the marginal ambulacral ones. Outside the scrobicular ring there are only a few secondary tubercles, the median part of the plates being otherwise naked and somewhat sunken. The horizontal sutures are deepened so as to form rather conspicuous grooves. There is no indication of grooves at the adradial end of the sutures, and the scrobicular tubercles leave no naked portion on the adradial side of the plates. The horizontal sutures between the upper areoles are not deepened. The median part of the interambulacra is about as wide as an areole.

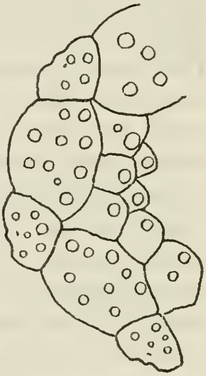


FIG. 17.—PART OF APICAL SYSTEM OF SCHIZOCIDARIS FASCIATA, NEW SPECIES. ×12

The apical system is exactly half the horizontal diameter and is rather elevated. The ocular plates are narrowly insert. The whole apical system is covered, though not very closely, with small tubercles of uniform size. The genital pores are not yet developed (fig. 17). The peristome is of the same size as the apical system, and is slightly elevated. There are 7 or 8 ambulacral plates in a series; the ambulacra join at the mouth edge so as to exclude the interradial plates from the mouth edge. There are 2 or 3 of the latter in each interradial space.

The longest ambital spines are nearly twice the horizontal diameter. They are nearly cylindrical, tapering only very slightly toward the point which is broadened into a small crown. At the base there are a few larger spinules, placed mainly at the sides; they do not unite so as to form a disk. Otherwise the spine is covered by rather numerous smaller spinules, arranged fairly distinctly in longitudinal series. As usual the spinules are smaller on the adoral than on the adapical side of the spine. The surface of the spine is otherwise covered by the smooth coat of hairs typical of *Schizocidaris;* it is somewhat more open-meshed and, therefore, less shining than usual. The collar as usual is very short, scarcely as long as the very inconspicuous milled ring. The apical spines are still in an immature condition. The oral primaries are slender and straight, with a few rather coarse lateral serrations. The third-fourth is transitional to the ambital spines.

The scrobicular spines are only about 1 mm. long; they are thin and flat with straight sides and straight cut ends. The marginal ambulacral spines are in the main of the same shape, but narrower and more slender; those near the peristome do not differ from the others. The miliary spines are of the usual slender form.

Only the small globiferous form of pedicellariae is represented. This is rather characteristic, the valves and also the opening being unusually short; the end tooth is very prominent (pl. 78, fig. 2). They are in general very small, with the head scarcely more than 0.1 mm. long and the stalk about 0.3–0.4 mm. long. In spite of this small size they are fairly conspicuous, partly because the head is rather thick, partly because they are somewhat brownish.

The spicules of the tube feet are of the usual spinous form.

In color the primaries are white, with 2 or 3 fairly distinct broad bands of pink. The secondaries and test are yellowish white. On the denuded test the genital plates are seen to be of a faint greenish color, the test being otherwise white.

Remarks.—In spite of the young age of the specimen, the genital pores being not yet developed, it offers such conspicuous characters in its primary spines and in its pedicellariae that there can be no doubt that it represents a distinct species of the genus *Schizocidaris.* The characters of the test must be expected to differ in adult specimens from what is found in the present young specimen; but the characters of the ambital spines and of the pedicellariae will evidently be quite sufficient for recognizing the species in its adult form.

PSILOCIDARIS, new genus[10]

Diagnosis.—Apical system more than half the horizontal diameter; peristome much smaller. Interambulacra with 6 or 7, ambulacra with rather numerous plates; a rather conspicuous sunken median line and fairly distinct grooves at the horizontal sutures in the interambulacra, but not in the ambulacra. Primary spines very long and slender, without basal disk; apical spines without terminal widening. Surface of primaries with short conical stumps. Secondary spines slender, setaceous, not appressed. Globiferous pedicellariae with slender valves in apparently both the large and small form.

---

[10] ψιλός=thin.

Genotype.—Psilocidaris echinulata Mortensen.

Remarks.—This genus apparently stands midway between *Goniocidaris* (subgenus *Cyrtocidaris*) and *Aporocidaris*, thus connecting the latter with the goniocidarids.

PSILOCIDARIS ECHINULATA, new species

Plate 60, figs. 1, 2; plate 61, figs. 4, 5; plate 63, fig. 4; plate 73, figs. 3, 4; plate 78, figs. 3–5

Localities.—Station 5127; Joló (Sulu) Sea, in the vicinity of southern Panay; Nogas Island (W.) bearing N. 11° 30′ E., 22 miles distant (lat. 10° 02′ 45″ N., long. 121° 48′ 15″ E.); 1,751 meters; bottom temperature 10.05° C.; gray mud and globigerinae; February 4, 1908 (1 specimen, the type, Cat. No. E. 1334, U.S.N.M.).

Station 5429; in the vicinity of eastern Palawan; Fondeado Island (SE.) bearing N. 18° E., 15 miles distant (lat. 9° 41′ 30″ N., long. 118° 50′ 22″ E.); 1,400 meters; green mud; April 5, 1909 (spines only, Cat. No. E. 1277, U.S.N.M.).

Measurements

h. d.	v. d.	Apical system	Peristome	Number of—		Longest spines
				I. a.	A. pro I. a.	
21 mm.	13 mm.	12.5 mm. (59.5 per cent h. d.)	7 mm. (33.3 per cent h. d.)	6	16–17	93 mm.
21 mm.	13 mm.	12 mm. (57 per cent h. d.)	6.5 mm. (30 per cent h. d.)	6–7	14–16	65 mm.

Description.—The test is low, gently vaulted above, somewhat flattened below, distinctly sunken toward the peristome. The sides are beautifully arched; the circumference is circular.

The ambulacra are rather distinctly sinuate. The interporiferous zone is about twice the width of a pore zone. The marginal series of tubercles is very regular; the tubercles are small and not contiguous. Within the marginal tubercle each plate carries a single tubercle about half as large as the marginal one, which is situated at the lower edge of the plate. There are thus four regular longitudinal series of tubercles in the interporiferous zone, filling it up nearly completely and leaving only a narrow naked sunken median line. The horizontal sutures are without distinct grooves. The pore zone is distinctly sunken; the pores are of about equal size, rather close together, the narrow wall separating them being only slightly raised. The ridge separating the pore pairs is narrow and only slightly elevated (pl. 73, figs. 3–4).

In the interambulacra the areoles are rather large, only slightly deepened, and well separated; only the 2 or 3 small proximal ones are confluent; even the lowermost ones are almost circular. The tubercle is rather small with the boss low; there is no trace of crenulation, but there are more or less distinct radiating furrows in the areole. The scrobicular ring of tubercles is rather inconspicuous, the tubercles being only a little larger than the marginal ambulacral tubercles. Outside the scrobicular ring the plate is covered by miliary tubercles of uniform size, leaving a rather conspicuous naked sunken median line, with a fairly distinct groove at the inner end of the horizontal sutures. On the adradial side of the scrobicular ring there are also some miliary tubercles. The median area is very narrow, only about one-third the width of an areole.

The apical system is rather unusually large, more than half the horizontal diameter and somewhat elevated. The ocular plates are all widely exsert; the madreporite is not enlarged. The periproct is rather small, with a moderate number of small periproctal plates. The whole apical system is closely covered with small tubercles of uniform size, leaving a narrow bare zone along the inner edge of the genital plates. The genital pores are large and are situated close to the outer edge of the plates (fig. 18). The peristome is only about half the size of the apical system and is distinctly sunken. There are only 3 or 4 ambulacral plates in a series; the ambulacra join at the mouth edge. The interradial areas are very small with only 1 or 2 small plates each.

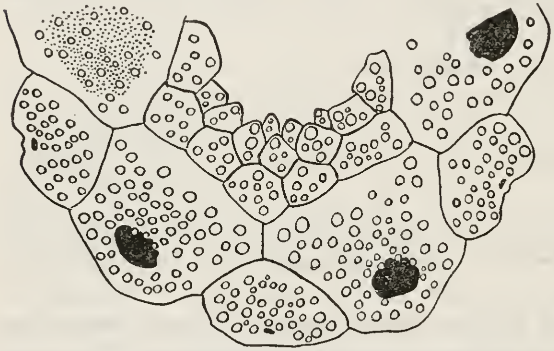


Fig. 18.—Part of apical system of Psilocidaris echinulata, new species. ×6

The primary spines are very long, four or five times the diameter of the test; even the longest spine in the best specimen has the point broken; in the second specimen not one of the ambital spines is complete. These spines are straight, very slender, cylindrical, tapering very gently to the (apparently) fine point. They are covered with small spinules which are erect or only very slightly curved distally; these are only very indistinctly arranged in about 8 longitudinal series; they rise directly from the surface of the spine, not from distinct ridges, and remain of the same size throughout the entire length of the spine. The surface of the spine is otherwise covered by very small, simple conical "hairs." There is no indication of a basal disk. The collar is about 1 mm. long, thickening toward the very inconspicuous milled ring. The apical spines are of full length, and there is no indication of apical disks. The oral primaries are very slender, smooth, with merely the point curved. The fourth is transitional to the ambital spines.

The secondary spines are in general slender. The scrobicular spines are about 3 mm. long, flattened, gently narrowing toward the rounded point; the marginal ambulacral spines are about 2 mm. long, very slender, and setaceous; the proximal ones are broadened and concave at the point. The miliary spines are simply setaceous. The secondaries are in general erect, only the scrobicular ones being somewhat appressed, but not forming a close mail around the base of the primaries.

Large globiferous pedicellariae were not observed. Small globiferous pedicellariae are rather abundantly developed; they are partly of the usual form, partly much elongated, so as to resemble tridentate pedicellariae, and partly of a somewhat coarser type (pl. 78, figs. 3–5). All of them have only a short and inconspicuous end tooth, which is sometimes scarcely at all distinct. The large coarse tridentate form, often found in goniocidarids, has not been observed here. The spicules are of the usual form—simple, slightly spiny rods.

In color the primaries are whitish with a pale pinkish tint, especially in the basal part. The secondaries are yellowish white. The skin of the test is of a yellowish-red tint, while the naked test is perfectly white.

Remarks.—This species to some degree resembles *Goniocidaris* (*Cyrtocidaris*) *tenuispina*, but differs so markedly from it, especially in the character of its primary spines, that it is out of question to include them in the same genus. On the other hand, it recalls to a still more marked degree the genus *Aporocidaris* in its very long and slender spines, its large apical system, etc. But it also is very conspicuously different from the species of that genus, especially in the much more numerous ambulacral plates and the pedicellariae, so that it seems equally unjustifiable to refer it to *Aporocidaris*. The only possible course, therefore, seems to be to make it the type of a separate genus, *Psilocidaris*. The fact that it is about equally closely related to *Goniocidaris* (*Cyrtocidaris*) on the one hand and to *Aporocidaris* on the other affords proof that the affinities of *Aporocidaris* must be with the goniocidarids, and we thus get a very satisfactory solution of the hitherto rather obscure question concerning the relationships of the genus *Aporocidaris*.

Genus STYLOCIDARIS Mortensen

STYLOCIDARIS EFFLUENS, new species

Plate 59, fig. 3; plate 62, figs. 1, 2; plate 65, figs. 1–4; plate 75, figs. 1, 2; plate 80, figs. 1–6

Localities.—Station 5194; off northern Cebu; Chocolate Island bearing N. 66° W., 8 miles distant (lat. 11° 15′ 30″ N., long. 124

11′ 00″ E.); 270 meters; bottom temperature 13.61° C.; green mud; April 3, 1908 (2 specimens, Cat. No. E. 1330, U.S.N.M.).

Station 5402; between Leyte and Cebu; Capitancillo Island Light bearing S. 37° W., 16.1 miles distant (lat. 11° 11′ 45″ N., long. 124° 15′ 45″ E.); 343 meters; bottom temperature 13.22° C.; green mud; March 16, 1909 (15 specimens, Cat. No. E. 1319, U.S.N.M.).

Station 5403; between Leyte and Cebu; Capitancillo Island Light bearing S. 46° W., 15.7 miles distant (lat. 11° 10′ 00″ N., long. 124° 17′ 15″ E.); 333 meters; bottom temperature 13.17° C.; green mud; March 16, 1909 (30 specimens, Cat. Nos. E. 1264, E. 1272, U.S.N.M.).

Station 5404; Dupon Bay, Leyte; Ponson Island (N.) bearing S. 79° E., 6.8 miles distant (lat. 10° 50′ 00″ N., long. 124° 26′ 18″ E.); 347 meters; bottom temperature 13° C.; mud; March 17, 1909 (5 specimens, including the type, Cat. No. E. 1316, U.S.N.M.).

Station 5410; in the vicinity of Dupon Bay, Leyte; Bagacay Point Light bearing S. 37° W., 7.2 miles distant (lat. 10° 28′ 45″ N., long. 124° 05′ 30″ E.); 704 meters; green mud; March 18, 1909 (8 specimens, Cat. No. E. 1297, U.S.N.M.).

Station 5411; between Cebu and Bohol; Lauis Point Light bearing N. 35° E., 4.7 miles distant (lat. 10° 10′ 30″ N., long. 123° 51′ 15″ E.); 265 meters; bottom temperature 12.89° C.; green mud; March 23, 1909 (4 specimens, Cat. No. E. 1315, U.S.N.M.).

Station 5412; between Cebu and Bohol; Lauis Point Light bearing N. 21° E., 5.5 miles distant (lat. 10° 09′ 15″ N., long. 123° 52′ 00″ E.) 296 meters; bottom temperature 12.67° C.; green mud; March 23, 1909 (3 specimens, Cat. No. E. 1299, U.S.N.M.).

Station 5415; between Cebu and Bohol; Lauis Point Light bearing N. 24° W., 7.2 miles distant (lat. 10° 07′ 50″ N., long. 123° 57′ 00″ E.); 161 meters; bottom temperature 16.89° C.; fine sand; March 24, 1909 (4 specimens, Cat. No. E. 1300, U.S.N.M.).

Station 5416; between Cebu and Bohol; Lauis Point Light bearing N. 12° E., 2.9 miles distant (lat. 10° 11′ 30″ N., long. 123° 53′ 30″ E.); 274 meters; bottom temperature 12.44° C.; green mud; March 25, 1909 (1 specimen, Cat. No. E. 1298, U.S.N.M.).

Station 5417; between Cebu and Bohol; Lauis Point Light bearing N. 10° E., 3.5 miles distant (lat. 10° 10′ 00″ N., long. 123° 53′ 15″ E.); 302 meters; bottom temperature 12.44° C.; gray mud and sand; March 25, 1909 (3 specimens, Cat. No. E. 1306, U.S.N.M.).

Station 5418; between Cebu and Bohol; Lauis Point Light bearing N. 16° E., 5.6 miles distant (lat. 10° 08′ 50″ N., long. 123° 52′ 30″ E.); 291 meters; bottom temperature 12.44° C.; gray mud and sand; March 25, 1909 (8 specimens, Cat. No. E. 1313, U.S.N.M.).

Station 5508; in the vicinity of northern Mindanao; Camp Overton Light, Iligan Bay, bearing S. 6° E., 4.9 miles distant (lat. 8° 17′ 24″ N., long. 124° 11′ 42″ E.); 493 meters, bottom temperature

11.83° C.; green mud and fine sand; August 5, 1909 (1 specimen, Cat. No. E. 1314, U.S.N.M.).

Station 5516; in the vicinity of northern Mindanao; Point Tagolo Light, Mindanao, bearing S. 80° W., 9.7 miles distant (lat. 8° 46′ 00″ N., long. 123° 32′ 30″ E.); 319 meters; bottom temperature 12.39° C.; globigerinae; August 9, 1909 (1 specimen, Cat. Nos. 1294, E. 1295, U.S.N.M.).

Station 5517; in the vicinity of northern Mindanao; Point Tagolo Light bearing S. 83° W., 10.5 miles distant (lat. 8° 45′ 30″ N., long. 123° 33′ 45″ E.); 309 meters; bottom temperature 12.39° C.; globigerinae; August 9, 1909 (3 specimens, Cat. No. E. 1282, U.S.N.M.).

Station 5522; in the vicinity of northern Mindanao; Point Tagolo Light bearing S. 39° W., 6 miles distant (lat. 8° 49′ 00″ N., long. 123° 26′ 30″ E.); 420 meters; bottom temperature 11.28° C.; globigerinae; August 10, 1909 (1 specimen).

Station 5536; between Negros and Siquijor; Apo Island (C.) bearing S. 26° W., 11.8 miles distant (lat. 9° 15′ 45″ N., long. 123° 22′ 00″ E.); 510 meters; bottom temperature 11.95° C.; green mud; August 19, 1909 (13 specimens, Cat. No. E. 1273, U.S.N.M.).

Measurements

h. d.	v. d.	Apical system	Peristome	Number of—		Longest spines
				I. a.	A. pro I. a.	
42 mm.	28 mm.	20 mm. (47.6 per cent h. d.)	19 mm. (45.2 per cent h. d.)	7	13–15	82 mm.
38 mm.	25 mm.	18 mm. (47.4 per cent h. d.)	17.5 mm. (46 per cent h. d.)	7	16–18	77 mm.
34 mm.	23 mm.	18 mm. (52.9 per cent h. d.)	16 mm. (47 per cent h. d.)	6	15–16	c. 50 mm.
32 mm.	20 mm.	16 mm. (50 per cent h. d.)	14 mm. (43.7 per cent h. d.)	6–7	14–16	52 mm.
31 mm.	20 mm.	15 mm. (48.4 per cent h. d.)	14 mm. (45.1 per cent h. d.)	6	14–16	55 mm.
31 mm.	18 mm.	15 mm. (48.4 per cent h. d.)	14 mm. (45.1 per cent h. d.)	6–7	14–15	53 mm
30 mm.	20 mm.	15 mm. (50 per cent h. d.)	13.5 mm. (45 per cent h. d.)	6	14–15	65 mm
29 mm.	16.5 mm.	12.5 mm. (43 per cent h. d.)	13 mm. (45 per cent h. d.)	6	13–14	
29 mm.	21 mm.	14.5 mm. (50 per cent h. d.)	12.5 mm. (43.1 per cent h. d.)	6 (7)	15–16	
27 mm.	14.5 mm.	12.5 mm. (46.3 per cent h. d.)	11.5 mm. (42.6 per cent h. d.)	5–6	13–16	54 mm.
21 mm.	12 mm.	11 mm. (52.4 per cent h. d.)	9 mm. (42.9 per cent h. d.)	6	12–13	55 mm.

Description.—The test is usually somewhat elevated above and flattened below, sometimes also flattened above; the sides are regularly arched, and the circumference is circular or more or less distinctly subpentagonal.

The ambulacra are usually distinctly sinuate. The interporiferous zone is about twice the width of a poriferous zone. The marginal series of tubercles is very regular, only now and then there is found a tubercle somewhat smaller or larger than the normal. The marginal tubercles are in general rather small and inconspicuous, little or not at all raised above the pore zone, whereas the interporiferous zone is generally slightly sunken toward the mid line. The tubercles are almost contiguous but there is still room left for some minute tubercles (of pedicellariae) between them, indeed often a regular series. Within the marginal tubercle each plate usually carries one or two much smaller tubercles at the lower edge, forming fairly regular longitudinal and, when two of them are present, horizontal series. The rest of the interporiferous zone is naked; sometimes, however, there is a tubercle near the median corner of the plate, or there may be two tubercles just within the marginal one, placed one at the lower edge, the other higher up; in such cases the regular serial arrangement of the inner tubercles is lost, and the naked character of the interporiferous zone much reduced. The pores are mostly about of equal size, but sometimes the inner pore is rather distinctly the larger. They are rather distant, with the wall between them fairly broad, low, and rounded; the ridge separating the adjoining pore pairs is low and rounded. The pores, generally speaking, might almost be termed semiconjugate (pl. 75, figs. 1–2). The pore zone is not sunken. The ambulacral plates are low and rather numerous. There is a considerable variation in the ambulacra. While the usual, and what would appear to be the more typical and normal, condition is that the space between the two series of marginal tubercles is fairly broad and naked, this space sometimes is so narrow as scarcely to give room for more than the one small tubercle within each marginal tubercle, or it may even be wider than usual, so as to give room for a regular series of up to five small tubercles at the lower edge of each plate.

In the interambulacra there are 6, more rarely 7, coronal plates in a series, the upper ones in each series more or less irregular, prolonged upward at the adradial edge, often to such a degree that the uppermost (rudimentary) plate is wholly excluded from the adradial edge. The tubercles are in general small and inconspicuous, the boss low and without a trace of crenulation. The areoles are only very little sunken. At most the 2 or 3 proximal ones are confluent, but more often even the lowermost ones are separated by a distinct series of tubercles; the proximal ones are rather distinctly transverse-oval. Above the ambitus the distance between the areoles usually increases considerably, thus giving room for several miliary tubercles between the neighboring scrobicular circles. The uppermost tubercle (and correspondingly the uppermost primary spine) in each series is more or less rudimentary, the areole widening irregularly on the adapical side, becoming effluent and more or less indistinct. The scrobicular ring of these upper areoles is likewise more or less rudimentary, extending toward the adapical side and here often quite open, and evidently obliterating. The scrobicular ring of the ambital tubercles is not raised and is relatively inconspicuous, even though these tubercles are about twice as large as the marginal ambulacral tubercles. Outside the scrobicular ring the plates are covered more or less closely with very small miliary tubercles, leaving a fairly distinct naked median line. On the adradial side of the scrobicular ring also there are several miliary tubercles, the scrobicular tubercles not coming very close to the edge. The median part is about half the width of an areole, scarcely at all sunken toward the mid line.

The apical system is usually about half the horizontal diameter, though rather variable in size, from 43 to 53 per cent of the horizontal diameter; it is usually somewhat elevated toward the middle. The oculars are usually insert, sometimes very narrowly so, sometimes more broadly; they are usually rather broad, more or less deeply excavated in the outer edge, the inner edges being more or less S-shaped. The genital plates are usually much narrower in their outer than in their inner part. The genital pores are small, rather distant from the outer edge. The periproct is of medium size, with a moderate number of plates. The whole apical system is rather densely covered with small tubercles of uniform size, only those at the inner edge of the genitals and on the periproctal plates being sometimes comma-shaped (fig. 19).

The peristome is usually somewhat smaller than the apical system, rarely a little larger, and quite flat. There are 10 or 11 ambulacral plates in a series, and 5 or 6 interradial plates in a fairly regular series; usually the ambulacra do not join at the peristomial edge, but the interradial plates do not reach to the mouth edge, even where the way is left open for them.

The primary spines are more or less slender, about one and one-half to two times the horizontal diameter, or even a little longer; they taper gradually to a simple blunt point. There are usually 9 or 10 sharp, rather coarsely serrate ridges, the surface being otherwise not very densely covered by short, very fine, not anastomosing hairs, which do not conceal the normal fine longitudinal striation. The collar is short, thickening toward the not very conspicuous milled ring. The oral primaries are very slender, straight, smooth, or very finely serrated longitudinally. The third or fourth is transitional to the ambital spines.

The secondary spines are slender and flattened; the scrobicular spines are about 4 mm. long, usually distinctly concave on the outside, sometimes with nearly straight edges, sometimes distinctly broader in the basal part and narrowing toward the slightly rounded point. The marginal ambulacral spines are much narrower and more simply spiniform. The miliary spines are flattened and pointed. The secondary spines are scarcely appressed.

Large globiferous pedicellariae are very rarely observed; they were detected only in one specimen (station 5517). They are of the typical form with no end tooth (pl. 80, fig. 4) and with a limb on the stalk. Small globiferous pedicellariae of two different forms occur; one (pl. 80, fig. 6) is the ordinary typical form of the usual structure, with the valves of regular shape, with a rather small terminal opening and a small but distinct end tooth. These usually have a long stalk, up to about 2.5 mm. in length, which makes them quite conspicuous, though the head scarcely exceeds 0.5 mm. in length. The other form (pl. 80, figs. 1–3) is very short stalked; the head, which is about 0.8 mm. long, is inclosed in a rather thick, apparently glandular skin; the valves are slender, with irregular serrate crests, and a small more or less irregular terminal opening, sometimes with a fairly distinct

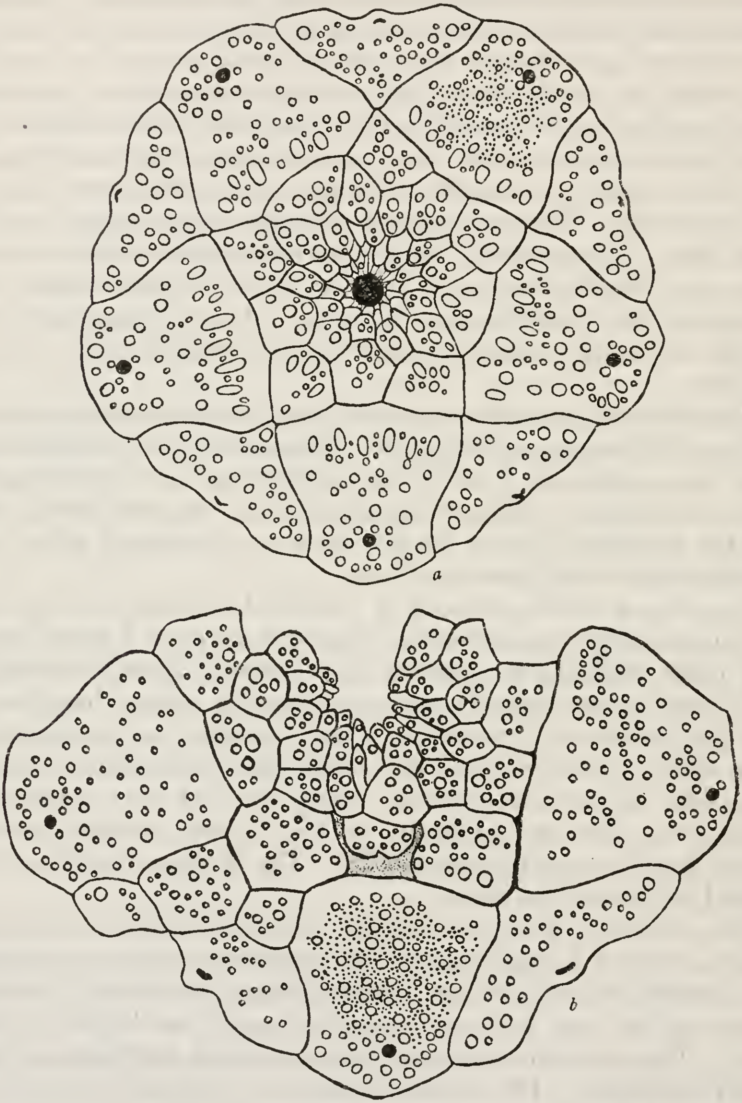


Fig. 19.—Apical system of Stylocidaris effluens, new species. In *b* one of the oculars is abnormally divided into several smaller plates. *a*×6, *b*×4

end tooth. This form, which occurs only between the scrobicular spines on the upper side of the test, usually bending inward over the base of the large spine muscles, is quite evidently a specialization of the small globiferous pedicellariae; indeed, transitional forms sometimes occur; one might even be tempted to regard them as abnormal small globiferous forms, but their fairly regular occurrence in the places designated both in this and in other species of *Stylocidaris* rather necessitates regarding them as a special form of pedicellariae, apparently characteristic of the genus *Stylocidaris*. They are usually few in number and are found on by no means all specimens. The tridentate pedicellariae (pl. 80, fig. 5) are numerous, fairly conspicuous, up to 1 mm. in length of head, with the stalk of very variable length, sometimes quite short, sometimes as long as 4 mm. The valves are very slender, widely gaping, and joining only near the end. The blade is narrow and deep, usually with a series of cross beams in the lower part; the edges are very finely serrate.

The spicules of the tube feet are simple, slightly spinous rods; in the intestinal wall there are numerous small irregular plates, or sometimes only a few more or less regular triradiate spicules.

In color the primary spines are whitish; the secondaries have a more or less conspicuous greenish or reddish longitudinal stripe. The test is whitish, only the apical system having a darker, greenish-brown or reddish tint, especially on the inner part of the genital plates and on the periproct.

Notes.—In the intestine I have found only detritus with unidentifiable remains of bottom organisms.

The small size of the eggs (only 0.1 mm. in diameter) and of the female genital openings would seem to indicate that this species has pelagic larvae.

Abnormalities are not rare, especially in the ambulacra; in one specimen ocular II and genital 1 are broken up into smaller plates (fig. 19*b*); in another genital 1 has two pores. A specimen from station 5410 is remarkable in having Amb. I double in its whole length (pl. 59, fig. 3). A parasitic gastropod (*Stylifer*?) sometimes is found in the primary spines, which are then usually transformed into globose galls, rarely growing out to anything like their normal length. The spines also are often overgrown with foreign organisms, mollusks (*Crepidula*), serpulids, barnacles, etc. In two specimens a very interesting case of regeneration was observed; one or two of the oral primaries have for some reason or other been lost, and instead of a new primary spine and tubercle some secondary spines and tubercles have been formed within the space of the original primary areole.

Some of the numerous specimens collected by the *Albatross* differ from the form which I regard as the typical one in that their primary spines are stouter and the tubercles and areoles on the upper plates are more normally developed. In some of them also the ocular plates are smaller than usual, and the ambulacra have a narrow interporiferous zone. Had these specimens been found alone, together with the typical form, I should not have hesitated to regard them as a seperate species. But the rich material at hand shows all transitional forms, so that it becomes quite impossible to distinguish the form with the stouter spines even as a variety.

Remarks.—The closest relationships of the present species are with *Stylocidaris tiara* (Alcock). It agrees with that species in the general character of the primary spines, which are in both provided with relatively few (7 or 8 in *tiara*, 9 or 10 in *effluens*) sharp prominent ridges, the surface of the spines otherwise being set with very short simple hairs; but these ridges are entire in *tiara*, while in *effluens* they are more or less coarsely serrate. Also in *tiara* the upper areoles are more or less effluent; but then the larger ambital tubercles are finely, but rather distinctly, crenulate in *tiara*, which they are not in *effluens*. Otherwise the characters of the two species are very much the same, but the differences indicated are sufficent to prove that they can not be regarded as identical.

It does not appear that *S. effluens* is more closely related to any other recent species. The peculiar effluent character so conspicuous in some specimens of this species recalls to some degree the fossil *Stereocidaris sceptrifera* (Mantell).[11] The character of the effluence of the areoles in this fossil form is, however, different from that of the recent form, and there is absolutely no close relationship between the recent and the fossil species.

STYLOCIDARIS REINI (Döderlein)

Plate 66, fig. 2; plate 67, fig. 2

Cidaris (*Dorocidaris*) *reini* DÖDERLEIN, Die japanischen Seeigel, I, Familien Cidaridae und Saleniidae, 1887, p. 7, pl. 4, figs. 1–7; pl. 8, figs. 4, *a–d*.

Cidaris (*Cidaris*) *reini* DE MEIJERE, Die Echinoidea der *Siboga*-Exped., 1904, p. 5, pl. 1, figs. 2–3; pl. 11, figs. 103–108.

Dorocidaris reini A. AGASSIZ and H. L. CLARK, Mem. Mus. Comp. Zoöl., vol. 34, No. 1, 1907, p. 10, pl. 3, figs. 1–14.

Tretocidaris reini H. L. CLARK, The Cidaridae, 1907, p. 207.

Stylocidaris reini H. L. CLARK, Cat. Recent Sea-urchins Brit. Mus., 1923, p. 24.

Localities.—Station 5367; Verde Island passage; Malabrigo Light bearing N. 81° E., 8 miles distant (lat. 13° 34′ 37″ N., long. 121° 07′ 30″ E.); 329 meters; sand; February 22, 1909 (8 specimens, Cat. No. E. 1317, U.S.N.M.).

Station 5617; Dodinga Bay, Gillolo; Ternate Island (SE.) bearing S. 45° W., 7 miles distant (lat. 0° 49′ 30″ N., long. 127° 25′ 30″ E.);

---

[11] See Th. Wright, Monograph of the British Fossil Echinodermata from the Cretaceous Formations. 1862–1882, pl. 6, fig. 1.

239 meters; coral; November 27, 1909 (1 specimen, Cat. No. E. 1331, U.S.N.M.).

Notes.—The specimen from station 5617 is notable for the fine pinkish color of the median stripe on the secondary spines, which gives the whole specimen a general pinkish hue; the apical system is not conspicuously darker than the rest of the specimen. The primary spines are very finely developed, white, with a pinkish base and with the serrate ridges very distinct and with scattered small wartlike elevations between the ridges; they are slightly swollen in the basal part. The hairs covering the general surface of the spine are very small and simple, as in the typical form. (See below, under the var. *cladothrix.*) This specimen measures 34 mm. in horizontal diameter; the longest primaries are 56 mm. in length, and 3. 5 mm. thick at the base.

The specimens from station 5367 are small, not exceeding 25 mm. in horizontal diameter, with slender spines; they are inconspicuously colored whitish yellow, with the apical system darker.

STYLOCIDARIS REINI, var. CLADOTHRIX, new variety

Plate 65, figs. 5–7; plate 66, fig. 1; plate 67, fig. 1; plate 75, fig. 4

Localities.—Station 5212, east of Masbate; Panalangan Point bearing S. 54° 30′ E., 14.5 miles distant (lat. 12° 04′ 15″ N., long. 124° 04′ 36″ E.); 197 meters; bottom temperature 15.50° C.; gray sand and mud; April 20, 1908 (9 specimens, Cat. Nos. E. 1361, E. 1362, E. 1367, U.S.N.M.).

Station 5392, between Sámar and Masbate, Tubig Point bearing N. 49° E., 5 miles distant (lat. 12° 12′ 35″ N., long. 124° 02′ 48″ E.); 247 meters; green mud and sand; March 13, 1909 (5 specimens, Cat. Nos. E. 1332, the type, E. 1333, U.S.N.M.).

Station 5398, between Masbate and Leyte, Gigantangan Island (S.) bearing S. 45° E., 2.7 miles distant (lat. 11° 35′ 12″ N., long. 124° 13′ 48″ E.); 208 meters; green mud; March 15, 1909 (1 specimen, Cat. No. E. 1378, U.S.N.M.). (See under var. *rubida.*)

Characters.—These specimens, which are all in a poor state of preservation, differ from the typical form in the shape of the hairs covering the surface of the spines. While in the typical form these are very small and simple, they are in the present form much larger, rather coarse, and bush-shaped (figs. 20 *a–b*).

These hairs are only distinguishable on clean, fully formed, and not too old and worn spines. Generally the spines are so dirty (from the contents of the trawl) or overgrown with foreign organisms that it is necessary to clean them by treating them with sodium hypochlorite and then rinsing them under a rather strong jet of water. In this way it is easy to get them perfectly clean, with the hair covering preserved in its full beauty, this word being not at all exaggeration.

This offers a rather striking character differentiating the two forms, so that it is tempting to regard the form with the bush-shaped hairs as a separate species, the more so as there are also some other differences. For instance, the secondary spines are rather more slender, especially the marginal ambulacral spines, and also more greenish than in the typical form. The primaries are white, or faintly banded with red, as in the typical form. The interporiferous area also is in general broader and more densely covered with miliary tubercles than in the type (pl. 75, fig. 4). Some of the specimens have the upper areoles more or less effluent, recalling the condition generally found in *S. effluens*. In fact, had I only these *Albatross* specimens at my disposal I should hardly have hesitated to regard this form as a separate species. However, the several specimens of both the typical form and of the variety which I have myself collected in the Japanese, Philippine, and Moluccan seas (at the Kei Islands) offer such an intermingling of all characters that I find it quite impossible to give any reliable characters other than the one pointed out above; that is, the difference in the shape of the hairs on the surface of the primary spines; but also in this character intermediate forms occur, which it is difficult, or rather, impossible, to refer definitely to one form or the other. Thus in spite of the conspicuous difference when forms pronouncedly illustrative of the two types are compared, I hold it unjustifiable to give the form with the bush-shaped hairs more than varietal rank.

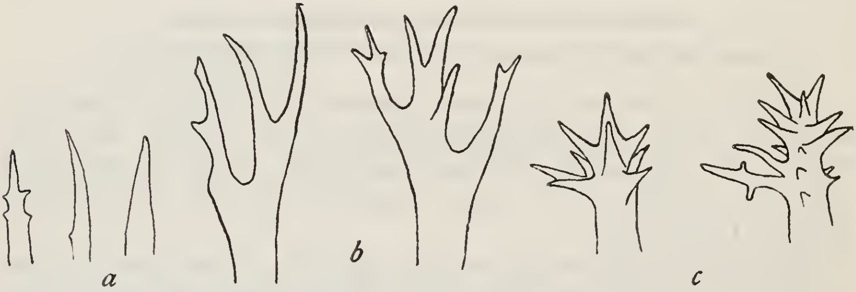


FIG. 20.—HAIRS FROM THE PRIMARY SPINES OF STYLOCIDARIS REINI (DÖDERLEIN) (*a*), ST. REINI, VAR CLADOTHRIX, NEW VARIETY (*b*), AND ST. ANNULOSA, NEW SPECIES (*c*). ×115

It may be mentioned that generally speaking the typical form has more slender primaries with somewhat less numerous serrate ridges than the variety, which generally has the primaries somewhat swollen at the base and the serrations more numerous, the serial arrangement often being indistinct. But in the *Albatross* specimens of the variety the serrations form distinct longitudinal series and the primaries are in general slender, whereas in the specimen of the typical form from station 5617, on the contrary, the primaries are swollen at the base (pl. 66, fig. 2). It should also be especially pointed out that the number of miliary tubercles in the interporiferous zone of the ambulacra varies to such a degree that no reliable distinguishing character can be found here.

Some of the specimens carry sea anemones, besides serpulids, sponges, and other organisms, on their spines.

STYLOCIDARIS REINI, var. RUBIDA, new variety

Plate 63, figs. 2, 3; plate 74, figs. 6, 7

Locality.—Station 5398; between Masbate and Leyte; Gigantangan Island (S.) bearing S. 45° E., 2.7 mile distant (lat. 11° 35′ 12″ N., long. 124° 13′ 48″ E.); 208 meters; green mud; March 15, 1909 (3 specimens, Cat. Nos. E. 1376, the type, E. 1377, U.S.N.M.).

Characters.—This form again is especially characterized by its primary spines and their hair covering. In the largest specimen, measuring 24 mm. in horizontal diameter, the longest spines are 60 mm. in length, thus two and one-half times the horizontal diameter, and very conspicuously banded with red and greenish white; the collar is greenish. They are very slightly thickened at the base, gradually tapering to a rather fine point. The spinules are arranged in distinct longitudinal series, but, especially on the adapical side where the spinules are somewhat larger than on the adoral side of the spine, so distant from each other as not to form distinct ridges, each spinule rising separately from the flat surface of the spine; especially on the red bands these white spinules stand out very distinctly; their base is rather broad, the spinule itself ending in a rather sharp point. The surface of the spine otherwise is covered with a coat of fine, short, simple hairs, which are more or less distinctly gathered into small groups, much as in the typical form.

The secondary spines are flat, not concave on the outer side as is usually the case in the typical form; the marginal ambulacral spines are rather broader than is usual in the typical form. In regard to the test it is noteworthy that the interporiferous zone is rather naked, there being only a single small tubercle on each plate within the marginal tubercle; this is placed at the lower edge of the plate (pl. 74, figs. 6, 7). There appear to be no other points of difference from the typical form.

While the larger specimen, to which the above description refers, differs rather markedly from the typical form, especially in its primary spines, a second specimen, nearly as large, 23 mm. in horizontal diameter (poorly preserved with all the spines broken), shows the characters pointed out above to a much smaller degree, being, in fact, quite intermediate between the variety and the typical form. A third specimen, of only 14.5 mm. in horizontal diameter, has the primaries of the same conspicuous red color as in the largest specimen, but is otherwise, of course, too young for a real comparison. The spinules of the primaries are disposed so as to form true ridges. Finally, a fourth small specimen from the same station 13.5 mm. in horizontal diameter has bush-shaped hairs on the primaries, and therefore must be referred to the variety *cladothrix.*

Remarks.—These facts seem to show the impossibility of giving this form more than varietal rank, none of the characters of the spines or the test being quite reliable as distinguishing features, and the pedicellariae showing no differences from those of the typical form. The discovery of a specimen of the variety *cladothrix,* together with the variety *rubida,* may also perhaps be taken as an indication of the small value to be attached to these varieties. Of course there would be nothing astonishing in getting two distinct varieties in the same haul, but on seeing the specimens together one would be rather inclined to regard them all as identical.

STYLOCIDARIS ANNULOSA, new species

Plate 63, fig. 1; plate 64, figs. 1–3; plate 65, fig. 8; plate 75, fig. 3; plate 80, figs. 7–11

Localities.—Station 5278; China Sea, in the vicinity of southern Luzon; Malavatuan Island (N.) bearing S. 23° E., 8.5 miles distant (lat.14° 00′ 10″ N., long. 120° 17′ 15″ E.); 186 meters; bottom temperature, 15.33° C.; fine sand, mud, and shells; July 17, 1908 (2 specimens, Cat. No. E. 1328, the type, U.S.N.M.).

Station 5369; in the vicinity of Marinduque Island; Tayabas Light (outer) bearing N. 50° W., 8.8 miles distant (lat. 13° 48′ 00″ N., long. 121° 43′ 00″ E.); 194 meters; broken shells; February 24, 1909 (9 specimens, Cat. Nos. E. 1268, E. 1327, E. 1329, U.S.N.M.).

Measurements

h. d.	v.d.	Apical system	Peristome	Number of— I. a.	Number of— A. pro I. a.	Longest spines
39 mm.	25 mm.	16 mm. (41 per cent h. d.)	11 mm. (28.2 per cent h. d.)	7–8	16–17	
38 mm.	23 mm.	16.5 mm. (46 per cent h. d.)	11.5 mm. (32.0 per cent h. d.)	7	16–17	ca. 70 mm. (?)
31 mm.	19 mm.	13.5 mm. (43.5 per cent h. d.)	10.5 mm. (34 per cent h. d.)	6–7	16–17	76 mm.
27 mm.	17 mm.	13.5 mm. (50 per cent h. d.)	9.5 mm. (35.2 per cent h. d.	6	16–17	ca. 75 mm.

Description.—The test is rather flattened above and below, sometimes gently vaulted above. The sides are regularly arched or, in the largest specimen, somewhat more vertical. The circumference is circular, in the largest specimen slightly subpentagonal.

The ambulacra are rather distinctly sinuate. The interporiferous zone is about twice the width of a pore zone. The marginal series of tubercles is perfectly regular; the tubercles are small and inconspicuous, nearly contiguous. Within the marginal tubercle each plate carries a single, much smaller, tubercle at the lower edge, the rest of the plate remaining naked except for a very small miliary tubercle; the interporiferous area thus is rather naked; it may be somewhat sunken toward the middle line. The pore zone is scarcely at all sunken; the pores are equal in size, and are separated by a fairly broad and slightly raised wall; the ridge separating the adjoining pore pairs is low and rounded (pl. 75, fig. 3).

In the interambulacra the areoles are very large and flat, scarcely at all deepened, showing a rather unusually distinct radial striation, but without a trace of crenulation; the boss is very low, the mamelon of ordinary size. At most the two proximal areoles are confluent, and only these proximal ones are more or less transverse oval. In the fourth or fifth the upper edge of the areole is generally straight, whereas the rest of it remains circular. The scrobicular ring is rather conspicuous, the tubercles being fairly large, three or four times as large as the marginal ambulacral tubercles. Outside the scrobicular ring there are some few miliary tubercles, leaving a narrow naked median space and also a narrow naked space on the adradial edge. The median area is very narrow, only about one-third the width of an areole.

The apical system is about 41 to 50 per cent of the horizontal diameter, relatively more in the smaller specimens than in the larger. The oculars are all rather widely exsert; only in one specimen ocular I is very narrowly insert. The oculars have the shape of a more or less acute triangle, with the inner sides nearly straight. The genital plates are rather high; the madreporite is not enlarged; the genital pore is near the edge; the female genital pores are small. The periproct is rather small, with a moderate number of periproctal plates. The whole apical system is more or less thickly covered with small fairly uniformly sized tubercles, some of which are more or less comma-shaped (fig. 21).

The peristome is conspicuously smaller than the apical system, about 28 to 35 per cent of the horizontal diameter, and like the apical system relatively larger in the smaller specimens. There are 9 or 10 ambulacral plates in a series in the largest specimen, but only from 6 to 8 in the specimen 27 mm. in horizontal diameter. In the largest specimen the pore series is slightly irregular, some of the pores being pushed slightly aside for want of space. The ambulacra do not join at the mouth edge, leaving a free passage for the interradial plates, which are from 3 to 6 in number and more or less irregular.

The primary spines are about two and one-half to three times as long as the diameter of the test, slender, 2 to 3 mm. thick, cylindrical, tapering very gradually to a rather fine point; the longer ambital spines are rather distinctly curved in the basal part. They are set with about 12 to 15 longitudinal series of low, rounded spinules which are generally not united at their base, thus not forming longitudinal ridges, excepting in the outer part of the spine. The surface of the spine is otherwise covered with sparse, low, bush-shaped hairs (fig. 20*c*). The collar is about 3 mm. long, increasing very slightly in thickness toward the very prominent milled ring. The apical primaries in adult specimens are apparently much shorter than the ambital ones, when fully formed. The oral primaries are very slender, smooth, and straight; the fourth is transitional to the ambital spines.

The secondary spines are very slender and pointed; the scrobicular ones are about 7 mm. long, flattened, with a slight concavity on the outer side in the basal part, made somewhat more conspicuous by a dark-colored median stripe (pl. 80, fig. 7); the marginal ambulacral spines are about 4 mm. long, almost setaceous. The miliary spines are likewise comparatively long and slender and are pointed. The secondary spines, even the scrobicular and marginal ambulacral spines, are generally erect; but this may probably, to some degree at least, be due to preservation.

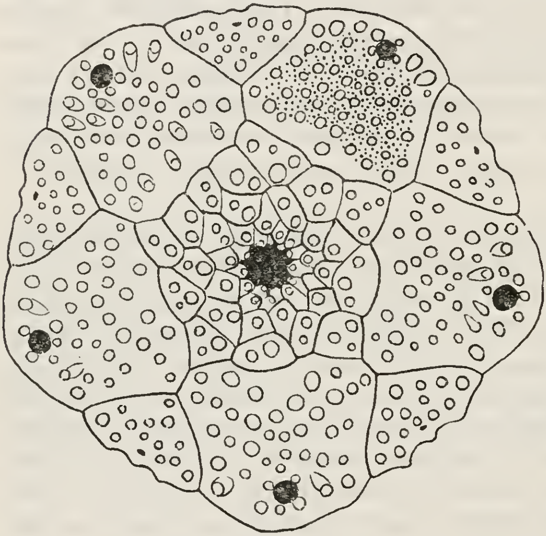


FIG. 21.—APICAL SYSTEM OF STYLOCIDARIS ANNULOSA, NEW SPECIES. ×6

The large globiferous pedicellariae which were observed only on the larger specimen from station 5278 (the type specimen) are of the usual form, with a well-developed limb on the stalk (pl. 80, fig. 9). The small globiferous pedicellariae are usually very long stalked, the stalk being up to 5 mm. in length and rather thick; the head is up to 1 mm. long; the valves are of the usual form, with a small, but distinct, end tooth (pl. 80, fig. 8). Tridentate pedicellariae are usually rather conspicuous, with the head upto 2.5 mm. long and the stalk of a length similar to that of the small globiferous. The valves (pl. 80, fig. 10) are very slender, separated for most of their length; the edge is somewhat irregularly widened at the base, otherwise finely serrate.

The spicules of the tube feet are of the usual form of simple more or less spinous rods. In the intestine they are partly irregular, fenestrated plates, partly, in the esophagus and the adoral part of the, intestine, small triradiate bodies (pl. 80, fig. 11*a*–*b*).

The primary spines have numerous narrow red bands which are separated by broader whitish or greenish bands. The red color almost disappears on the adoral side of the spine, which is nearly white. The secondary spines are whitish, with a more or less conspicuous greenish brown median stripe. The naked test is whitish, the upper side darker. The genital plates and the periproct are rather dark, greenish brown, against which color the white oculars stand out very markedly (pl. 64, fig. 2). The greenish-brown color continues more or less on to the interambulacra; the primary tubercles are grayish green. From the outer edge of the oculars, which is also greenish brown, this color continues along the series of marginal ambulacral tubercles and the adjoining part of the pore zone almost to the oral side of the test. The interporiferous zone of the ambulacra is otherwise white, or at least whitish.

Notes.—The intestine of a specimen opened was completely empty thus giving no information in regard to the food. The small size of the female genital openings and of the eggs, which are about 0.1 mm. in diameter, indicate that the species has probably a pelagic larva. The spines are rather heavily overgrown by bryozoans and barnacles, mainly *Scalpellum.* Some of the primaries carry at the outer end a conspicuous tuft of a peculiar ctenostomatous bryozoan, with a small head on a long simple stalk. These tufts are usually confined to the adoral side of the spine and hang downward.

Remarks.—This species, so very well characterized through its peculiar large flat areoles, its long banded spines, and its unusually slender secondary spines, besides the characteristic coloration, is not very closely related to any other known species of *Stylocidaris*; the nearest relationships would seem to be with *S. reini*, but it is not very near that form. All the specimens at hand are remarkably uniform in their main characters.

Genus STEREOCIDARIS Pomel

STEREOCIDARIS GRANDIS Döderlein

Stereocidaris grandis Döderlein, Die japanischen Seeigel, I, Familien Cidaridae und Saleniidae, 1887, p. 3, pl. 1, figs. 1–6; pl. 2, figs. 1–11; pl. 8, figs. 2, *a–m*.—de Meijere, Die Echinoidea der *Siboga*-Exped., 1904, p. 17.—A. Agassiz and H. L. Clark, Mem. Mus. Comp. Zoöl., vol. 34, No. 1, 1907, p. 22, pl. 5, figs. 18–20, pls. 33, 36.—H. L. Clark, Bull. Mus. Comp. Zoöl., vol. 51, No. 7, 1907, p. 220; Cat. Recent Sea-urchins Brit. Mus., 1925, p. 26.

Localities.—Station 5281; China Sea, in the vicinity of southern Luzon; Malavatuan Island (N.) bearing S. 84° W., 4.3 miles distant (lat. 13° 52′ 45″ N., long. 120° 25′ 00″ E.); 367 meters; bottom temperature 10.22° C.; dark gray sand; July 18, 1908 (1 specimen, Cat. No. E. 1303, U.S.N.M.).

Station 5283; China Sea, in the vicinity of southern Luzon; Malavatuan Island (N.) bearing N. 64° W., 8.75 miles distant (lat. 13° 48′ 30″ N., long. 120° 28′ 40″ E.); 512 meters; bottom temperature 8.22° C.; dark gray sand; July 18, 1908 (1 specimen, Cat. Nos. E. 1349, E. 1350, U.S.N.M.).

Station 5325; off northern Luzon; Hermanos Island (N.) bearing N. 86° E., 16.75 miles distant (lat. 18° 34′ 15″ N., long. 121° 51′ 15″ E.); 409 meters; bottom temperature 11.78° C.; green mud; November 12, 1908 (4 specimens, Cat. No. E. 1347, U.S.N.M.).

Station 5326; off northern Luzon; Hermanos Island (N.) bearing N. 69° E., 8 miles distant (lat. 18° 32′ 30″ N., long. 122° 01′ 00″ E.); 420 meters; bottom temperature 13.00° C.; mud; November 12, 1908 (1 specimen, Cat. No. E. 1348, U.S.N.M.).

Station 5392; between Sámar and Masbate; Tubig point bearing N. 49° E., 5 miles distant (lat. 12° 12′ 35″ N., long. 124° 02′ 48″ E.); 247 meters; green mud and sand; March 13, 1909 (1 specimen, Cat. Nos. E. 1301, E. 1302, U.S.N.M.).

Station 5459; east coast of Luzon; Legaspi Light bearing S. 88° W., 14.3 miles distant (lat. 13° 10′ 21″ N., long. 123° 59′ 54″ E.); 367 meters; June 8, 1909 (2 specimens, Cat. No. E. 1288, U.S.N.M.).

Station 5527; between Bohol and Siquijor; Balicasag Island (C.) bearing N. 14° W., 8.2 miles distant (lat. 9° 22′ 30″ N., long. 123° 42′ 40″ E.); 716 meters; bottom temperature 11.83° C.; globigerina ooze; August 11, 1909 (1 specimen, Cat. No. E. 1304, U.S.N.M.).

Remarks.—The identification of these specimens with *Stereocidaris grandis* I must regard as provisional, as I have a suspicion that some confusion has taken place with regard to that species and *S. microtuberculata* (Yoshiwara); the latter would rather seem to be the true *S. grandis*, while the form here called *S. grandis*, so far as I can judge, in conformity with H. L. Clark and de Meijere, should probably receive a new name. The question can not, however, be settled until after a renewed examination of the type material. It may only be pointed out on this occasion that the main character distinguishing *grandis* from *microtuberculata*, according to Clark[12] the width of the ambulacra, namely, 25 to 33 per cent of the interambulacra in *grandis* and only 18 to 25 per cent in *microtuberculata*, does not hold very well. From the measurements given by Döderlein[13] it is seen that in his original specimens of *S. grandis* the ambulacra are only 23 to 28 per cent of the interambulacra. A careful comparison of a specimen identified by H. L. Clark as *microtuberculata* with Döderlein's description and figures of his *S. grandis* seems to me to leave but very little doubt that they are identical.

---

[12] The Cidaridae, p. 218.

[13] Jap. Seeigel, p. 49.

The specimen from station 5527 has the primaries somewhat thickened above the collar, then tapering gradually to the rather fine point which is not widened into a crown in those few that are intact; they are of a faint pinkish tint. The specimen measures 30 mm. in horizontal diameter, the longest spines being about 70 mm. in length. Possibly this will ultimately prove to represent a separate variety or even species. For the present I can, however, only regard it as belonging, together with the other specimens here mentioned, to *S. grandis.*

The specimen from station 5392 is abnormal in having genital 1 divided into two almost equal halves, each with its genital pore.

STEREOCIDARIS GRANDIS, var. RUBRA, new variety

Plate 68, figs. 1, 2

Locality.—Station 5135; in the vicinity of Joló (Sulu); Joló Light bearing S. 46° W., 11.9 miles distant (lat. 6° 11′ 50″ N., long. 121° 08′ 20″ E.); 294 meters; bottom temperature 14.11° C.; fine coral sand; February 7, 1908 (1 specimen, the type, Cat. No. E. 1336, U.S.N.M.).

Measurements

h. d.	v. d.	Apical system	Peristome	Width of—		Number of—		Longest spines
				I. a	A.	I. a.	A. pro I. a.	
52 mm	29.5 mm	23 mm. (44.2 per cent h. d.).	22 mm. (42,3 per cent h. d.).	25 mm	5.5 mm	5–6	24–25	55 mm.

Characters.—In its general characters this specimen is so very like the typical *S. grandis* that there would be no reason to keep it separate were it not for its very conspicuous red color. Not only the spines, primaries, secondaries, and miliaries are of a deep red, but the naked test also is intensively red, even down to the peristome; the red color is also found in the areoles, in the ambital ones only as radiating streaks, while the uppermost complete areole is wholly red; the upper part of the boss and the mamelon remain white. In the ambulacra the interporiferous zone is also intensively red, nearly down to the peristome, while the pore zone remains whitish.

As the typical form may also have a more or less conspicuous reddish tint on the apical system and in the uppermost part of the interambulacra, it is rather probable that this color difference is not sufficiently reliable to permit us to regard this form as a separate species, and, at least so long as only this single specimen is known, it would seem best to regard it only as a variety of *S. grandis.*

STEREOCIDARIS MICROTUBERCULATA Yoshiwara

Plates 69, 70

Cidaris (*Stereocidaris*) *microtuberculata* Yoshiwara, Annot. Zool. Jap., vol. 2, 1898, p. 57; Zool. Mag. Tokyo, vol. 18, 1906, pl. 1, figs. 6, 7.

Stereocidaris microtuberculata H. L. Clark, Bull. Mus. Comp. Zoöl., vol. 51, No. 7, 1907, p. 220, pls. 1, 2.—A. Agassiz and H. L. Clark, Bull. Mus. Comp. Zoöl., vol. 51, No. 5, 1907, p. 112.

Localities.—Station 5162; Tawi Tawi group, Joló (Sulu) Archipelago; Tinagta Island (S.) bearing N. 71° W., 5.4 miles distant (lat. 5° 10′ 00″ N., long. 119° 47′ 30″ E.); 420 meters; bottom temperature 11.61° C.; coarse sand and broken shells; February 22, 1908 (1 specimen, Cat. Nos. E. 1363, E. 1364, U.S.N.M.).

Station 5475; east coast of Luzon; San Bernadino Light bearing S. 27° W., 11 miles distant (lat. 12° 55′ 25″ N., long. 124° 22′ 12″ E.); 356 meters; bottom temperature 15.17° C.; shells; June 24, 1909 (1 specimen, Cat. No. E. 1271, U.S.N.M.).

Notes.—These two specimens differ a little from the typical form from the Sagami Sea in the character of the primaries. While in the three specimens I have seen of the typical form the longitudinal ridges of the primaries are very narrow and only very slightly serrate, leaving a rather broad space between them which is covered with a spongy coat of fine anastomosing hairs, the ridges in the present form are broader and more densely serrate; the space between the ridges is thus narrower than in the typical form, but the hair covering is otherwise in the main the same. It is further remarkable that, especially in the larger specimen from station 5475, the ridges are so very much worn as to be scarcely recognizable as such, and the spines look very smooth, almost as if polished; the spines are on the whole very clean. It seems rather puzzling, how they could have become thus worn.

The primaries of the larger specimen are rather distinctly compressed, especially toward the end, which is somewhat widened and obliquely cut, as if they had been used for walking. The primaries are white, slightly darker on the collar. The scrobicular spines and the spines around the anal and the genital openings are of a slight greenish tint; the miliary spines are otherwise of a slight brownish tint. In the second specimen the scrobicular spines do not show any greenish tint; in this specimen a pair of developing apical primaries are of a deep violet tint.

The primaries are rather long and slender; in the larger specimen, which is 53 mm. in horizontal diameter, the longest spines are 85 mm. in length; in the second specimen, which is 36 mm. in horizontal diameter, the spines are up to 63 mm. long. On the latter a specimen of the little synaptid *Taeniogyrus cidaridis* Ohshima is wound around one of the spines.

The differences pointed out above between these specimens and the typical form are so slight that I do not think it justifiable to designate them as a separate variety.

Specimens of this species were taken by the author at the Kei Islands (1922), it being thus evidently widely distributed over the Malayan region.

STEREOCIDARIS INDICA Döderlein

Stereocidaris indica DÖDERLEIN, Zool. Anzeiger, vol. 23, 1901, p. 19.—DE MEIJERE, Die Echinoidea der *Siboga*-Exped., 1904, p. 18, pl. 1, fig. 1; pl. 11, figs. 119, 120; pl. 12, fig. 121.—DÖDERLEIN, Wiss. Ergeb. d. Tiefsee-Exped., vol. 5, Lief. 2, 1906, p. 104; pl. 10, figs. 1, 2; pl. 11, figs. 1–6; pl. 12, figs. 3–10; pl. 36, figs. 5–9; pl. 37, figs. 2–7.—H. L. CLARK, Bull. Mus. Comp. Zoöl., vol. 51, No. 7, 1907, p. 218; Cat. Recent Sea-urchins Brit. Mus., 1925, p. 26.

Localities.—Station 5119; Verde Island Passage; Sombrero Island bearing S. 80° E., 18.9 miles distant (lat. 13° 45′ 05″ N., long. 120° 30′ 30″ E.); 720 meters; bottom temperature 6.50° C.; green mud and sand; January 21, 1908 (4 specimens, Cat. Nos. E. 1321, E. 1322, U.S.N.M.).

Station 5300; China Sea, in the vicinity of southern Luzon; (lat. 20° 31′ 00″ N., long. 115° 49′ 00″ E.); 484 meters; gray mud and sand; August 8, 1908 (1 specimen, Cat. No. E. 1352, U.S.N.M.).

Station 5348; Palawan passage; Point Tabonan bearing S. 89° E., 33.5 miles distant (lat. 10° 57′ 45″ N., long. 118° 38′ 15″ E.); 685 meters; bottom temperature 13.56° C.; coral sand; December 27, 1908 (1 specimen, Cat. No. E. 1388, U.S.N.M.).

Station 5445; east coast of Luzon; Atalaya Point, Batag Island, bearing S. 64° E., 3.6 miles distant (lat. 12° 43′ 05″ N., long. 125° 01′ 00″ E.); 700 meters; bottom temperature 6.83° C.; green mud and sand; June 3, 1909 (1 specimen, Cat. No. E. 1323, U.S.N.M.).

Station 5450; east coast of Luzon; East Point, Batan Island, bearing S. 36° E., 9.2 miles distant (lat. 13° 23′ 15″ N., long. 124° 00′ 30″ E.); 745 meters; bottom temperature 5.72° C.; green mud and coral; June 4, 1909 (1 specimen, Cat. No. E. 1293, U.S.N.M.).

Station 5591; Sibuko Bay, Borneo; Mabul Island (NW.) bearing N. 6° W., 3.1 miles distant (lat. 4° 11′ 48″ N., long. 118° 38′ 20″ E.); 475 meters; September 29, 1909 (1 specimen, Cat. No. E. 1305, U.S.N.M.).

Station 5592; in the vicinity of Sibuko Bay, Borneo; Silungan Island (M.) bearing N. 1° W., 6.4 miles distant (lat. 4° 12′ 44″ N., long. 118° 27′ 44″ E.); 557 meters; bottom temperature 6.28° C.; green mud; September 29, 1909 (2 specimens, Cat. No. E. 1365, U.S.N.M.).

Remarks.—The specimens correspond with the var. *africana* or *integra* of Döderlein. They all have cylindrical primaries, without any indication of elevated crests and without terminal broadening. There are, however, a few minor differences. The test is more or less sunken toward the peristome; the number of ambulacral plates corresponding to an interambulacral plate at the ambitus is about 20 (otherwise 12–17 in this species); tridentate pedicellariae are usually fairly numerous but sometimes very scarce or even absent (apparently otherwise absent in this species). Possibly these differences will ultimately necessitate distinguishing these specimens as a separate variety (or species?); but in view of the great variability of *Stereocidaris indica* I would think it preferable, for the present at least, simply to consider them as *S. indica.*

The specimen from station 5450 is notable through the unusual length of the primaries, up to 82 mm. long in a size of 32 mm. horizontal diameter. The color of this specimen also is unusually dark, but this may be due to preservation. One of the specimens from station 5119 is infested with a group of parasitic snails (*Stylifer*, species?) and has thereby become somewhat deformed. The specimen from station 5348 is a young one and the identification uncertain; this also applies to one of the specimens from station 5592.

STEREOCIDARIS SCEPTRIFEROIDES, var. LAMELLATA, new variety

Plates 71, 72; plate 74, figs. 8, 9; plate 78, figs. 13, 14

Locality.—Station 5630; south of Patiente Strait; Doworra Island (N.) bearing N. 3° W., 4.5 miles distant (lat. 0° 56′ 30″ S., long. 128° 05′ 00″ E.); 1,040 meters; coral sand and mud; December 2, 1909 (1 specimen, the type, Cat. No. E. 1286, U.S.N.M.).

Measurements

h. d.	v. d.	Apical system	Peristome	Width of—		Number of—		Longest spines
				I. a.	A.	I. a.	A. pro I. a.	
26 mm.	16.5 mm.	12.5 mm. (48 per cent h. d.)	9.5 mm. (36.5 per cent h. d.)	12.5 mm.	3 mm.	5–6	13–14	55 mm.

Description.—The test is rather low, distinctly flattened above, slightly less so below, and not sunken toward the peristome. The sides are regularly arched. The circumference is circular. The ambulacra are distinctly sinuate. The interporiferous zone is not much broader than a pore zone. The marginal series of tubercles is very regular, the tubercles not contiguous, usually separated by a pair of small miliary tubercles. Inside the marginal tubercle each plate carries a secondary tubercle about half the size of the marginal one, or even larger, situated at the lower corner of the plate. These secondary tubercles form a pair of very regular longitudinal series within the marginal series, and the whole interporiferous zone is so narrow that it is quite filled up by those four series, no naked median space being left. Rarely there are two smaller inner tubercles instead of the normal one at the lower edge; in such a case a slight irregularity is caused in the vertical series. The pores are about equal in size, and are separated by a fairly broad scarcely elevated wall, whereas the ridge separating the pore pairs is rather high, the pores thus being fairly deep lying (pl. 74, figs. 8–9).

In the interambulacra the areoles are fairly deep and well separated, at most the two proximal ones being confluent; those on the oral side are slightly transverse-oval. The uppermost areole is rudimentary and without a primary spine, as is usual in stereocidarids; but the areole and its tubercle are not so very small. The scrobicular ring is very regular, rather conspicuous, but not raised, the tubercles being more than twice as large as the marginal ambulacral ones, and almost contiguous; outside the scrobicular ring the plates are covered with small miliary tubercles of uniform size, which leave just an indication of a naked, but not sunken, vertical median line. There is an indication of fine horizontal transverse furrows, especially on the oral side. The median interambulacral area is scarcely half as broad as an areole.

The apical system is nearly half the horizontal diameter. The oculars are all widely exsert, small, with the inner edge forming almost a half circle. Both genitals and oculars are rather elevated, and are covered, not very closely, with tubercles of uniform size, leaving a rather broad edge bare. The genital pores are near the outer edge (fig. 22). The madreporite is not enlarged. The periproct is small, with rather few periproctal plates. The peristome is flat, distinctly smaller than the apical system; there are 8 ambulacral plates in a series, the ambulacra joining each other at the mouth edge. The interradial plates are small, arranged in a fairly regular double series of 4 or 5 plates in each series.

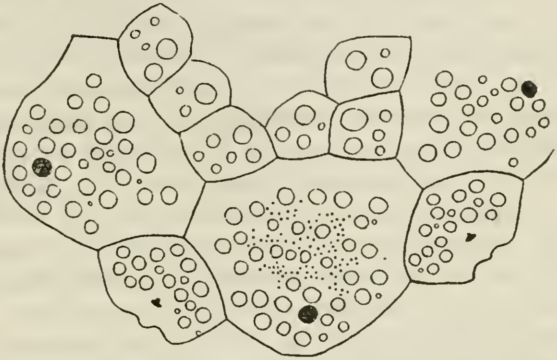


FIG. 22.—PART OF APICAL SYSTEM OF STEREOCIDARIS SCEPTRIFEROIDES, DÖDERLEIN, VAR. LAMELLATA, NEW VARIETY. ×6

The primary spines are conspicuously swollen at the base, thence tapering gradually toward the tip, which is rather conspicuously widened, with a central depression. The upper primaries are about twice as long as the horizontal diameter; they diminish in length very rapidly toward the oral side. In the basal part the larger upper primaries are provided with about 12 prominent closely serrate narrow ridges, which give the spine a lamellate appearance. In the outer half these ridges become quite low, rising again at the expanded tip. The surface of the spine between and on the sides of the ridges is covered with a close coating of fine anastomosing hairs. The ridges begin about 2 mm. above the collar, which is very low, scarcely 1 mm. high, and very inconspicuous, as is the milled ring. The portion of the spine between the collar and the ridges is very conspicuous being smooth and shining and of a pinkish color. The oral primaries are slightly curved, flattened, slightly broadened, with the edges fairly distinctly serrate. They have a couple of conspicuous ridges on both the oral and aboral side; only the innermost may be quite smooth on both sides. The third is transitional to the ambital spines.

The scrobicular spines are about 3 mm. long, rather thick, with the outer side slightly convex and the inner side concave with a median ridge. The sides are straight, not narrowing toward the end, which is slightly rounded. The marginal ambulacral spines are about 2 mm. long, narrow, straight, and slightly flattened; near the peristome they are somewhat broadened and concave toward the end. The miliary spines are simply spine-shaped, very conspicuously smaller than the scrobicular and marginal ambulacral spines; transitional sizes are scarcely to be found around the scrobicular ring. The miliary spines are rather erect, the others appressed.

Large globiferous pedicellariae are very scarce; their valves (pl. 78, fig. 14) are long and very narrow, with a small subterminal opening, the outermost teeth of which join so as to form an apparently unpaired end tooth. The stalk is very short and simple. The small globiferous pedicellariae (pl. 78, fig. 13) likewise have narrow and rather elongate valves of very simple structure. No tridentate pedicellariae were observed.

The spicules are of the usual stereocidarid shape.

The primary spines are of a slightly pinkish tint, the portion between the collar and the ridges being more conspicuously pink. The secondaries are brownish. The naked test is pure white.

Remarks.—This form evidently is so closely related to *Stereocidaris sceptriferoides* Döderlein that it might well be questioned whether it should not simply be designated as *sceptriferoides.* The shape of the primaries, however, seems to be rather conspicuously different, judging from Döderlein's description and figures. The scrobicular spines also would seem to be different, judging from the description of *sceptriferoides*, and likewise the shape of the large globiferous pedicellariae is not in accordance with the figure given by Döderlein. It is very possible that these and the other minor differences which according to the descriptions exist are no more than what may well be found within the limits of the species; but so long as no material has been brought to light to show this species to be so variable, it does not seem justifiable simply to unite the form from the Philippine Sea with the Japanese species, which is not yet known from beyond the Japanese seas. In view of the insufficient knowledge of *S. sceptriferoides* I have thought it well to give a full description of the specimen at hand, be it simply identical with the Japanese species, or a separate variety, or perhaps a distinct species.

EXPLANATION OF PLATES

Plate 48

Histocidaris magnifica, new species. Side view. Natural size

Plate 49

Histocidaris magnifica, new species. Seen from the oral side. Natural size

Plate 50

Histocidaris acutispina. Natural size

Fig. 1. Seen from the oral side.
2. Seen from the aboral side.

Plate 51

Histocidaris, species. Natural size

Fig. 1. Side view.
2. Seen from oral side.

Plate 52

All figures natural size

Fig. 1. *Histocidaris elegans*, naked test, side view.
2. *Histocidaris acutispina*; primary spines.
3. *Prionocidaris bispinosa*; primary spines.

Plate 53

Prionocidaris baculosa, var. *annulifera*; oral side. Natural size

Plate 54

Prionocidaris baculosa, var. *annulifera*; aboral side. Natural size

Plate 55

Goniocidaris (*Discocidaris*) *peltata*, new species; aboral side. Natural size

Plate 56

Goniocidaris (*Discocidaris*) *peltata*, new species; oral side. Natural size

Plate 57

All figures natural size

Fig. 1. *Goniocidaris* (*Cyrtocidaris*) *tenuispina*, new species; aboral side.
2. Same specimen; oral side.
3. *Goniocidaris* (*Cyrtocidaris*) *tenuispina*, new species, var. *tuberculata*, new variety; aboral side.

PLATE 58

Both figures natural size

FIG. 1. *Goniocidaris* (*Cyrtocidaris*) *tenuispina*, new species. Side view.
2. *Goniocidaris* (*Cyrtocidaris*) *tenuispina*, new species, var. *major*, new variety; aboral side.

PLATE 59

All figures natural size

FIG. 1. *Goniocidaris* (*Cyrtocidaris*) *tenuispina*, new species, var. *tuberculata*, new variety. Side view.
2. *Goniocidaris* (*Cyrtocidaris*) *tenuispina*, new species; aboral side.
3. *Stylocidaris effluens*, new species, side view; abnormal specimen, showing double ambulacrum.

PLATE 60

Both figures natural size

FIG. 1. *Psilocidaris echinulata*, new species; aboral side.
2. *Psilocidaris echinulata*, new species; oral side.

PLATE 61

All figures natural size

FIG. 1. *Schizocidaris serrata* Mortensen; oral side.
2. *Rhopalocidaris hirsutispina* (de Meijere), var. *viridis*, new variety. Half side view, aboral side.
3. *Schizocidaris fasciata*, new species. Side view.
4. *Psilocidaris echinulata*, new species; aboral side.
5. *Psilocidaris echinulata*, new species; oral side.
6. *Goniocidaris* (*Cyrtocidaris*) *tenuispina*, new species, male; aboral side.
7. *Goniocidaris* (*Cyrtocidaris*) *tenuispina*, new species; oral side.
8. *Goniocidaris* (*Cyrtocidaris*) *tenuispina*, new species, female; aboral side.
9. *Goniocidaris* (*Cyrtocidaris*) *tenuispina*, var. *tuberculata*, new variety; side view.
10. *Goniocidaris* (*Cyrtocidaris*) *tenuispina*, var. *tuberculata*, new variety; oral side.
11. *Goniocidaris* (*Cyrtocidaris*) *tenuispina*, var. *tuberculata*, male; aboral side

PLATE 62

Both figures natural size

FIG. 1. *Stylocidaris effluens*, new species; aboral side.
Stylocidaris effluens, new species; oral side.

PLATE 63

All figures natural size

FIG. 1. *Stylocidaris annulosa*, new species; aboral side.
2. *Stylocidaris reini* (Döderlein), var. *rubida*, new variety; oral side.
3. *Stylocidaris reini* (Döderlein), var. *rubida*, new variety; aboral side.
4. *Psilocidaris echinulata*, new species. Spines (station 5429).
5. *Goniocidaris* (*Cyrtocidaris*) *tenuispina*, new species. Spines.

PLATE 64

All figures natural size

FIG. 1. *Stylocidaris annulosa*, new species; oral side.
2. *Stylocidaris annulosa*, new species, naked test; aboral side.
3. *Stylocidaris annulosa*, new species, naked test; oral side.

PLATE 65

All figures natural size

FIG. 1. *Stylocidaris effluens*, new species, naked test; aboral side.
2. *Stylocidaris effluens*, new species, naked test; oral side.
3. *Stylocidaris effluens*, new species. Half side view.
4. *Stylocidaris effluens*, new species. Side view.
5. *Stylocidaris reini* (Döderlein), var. *cladothrix*, new variety, naked test; aboral side.
6. *Stylocidaris reini* (Döderlein), var. *cladothrix*, new variety, naked test; oral side.
7. *Stylocidaris reini* (Döderlein), var. *cladothrix*, new variety, naked test. Side view.
8. *Stylocidaris annulosa*, new species, naked test. Side view.

PLATE 66

The figures are natural size

FIG. 1. *Stylocidaris reini* (Döderlein), var. *cladothrix*, new variety; aboral side.
2. *Stylocidaris reini* (Döderlein); aboral side.

PLATE 67

The figures are natural size

FIG. 1. *Stylocidaris reini* (Döderlein), var. *cladothrix*, new variety; oral side.
2. *Stylocidaris reini* (Döderlein); oral side.

PLATE 68

The figures are natural size

FIG. 1. *Stereocidaris grandis* Döderlein, var. *rubra*, new variety; aboral side.
2. *Stereocidaris grandis* Döderlein, var. *rubra*, new variety; oral side.

PLATE 69

FIG. 1. *Stereocidaris microtuberculata* Yoshiwara; aboral side. Natural size.

PLATE 70

FIG. 1. *Stereocidaris microtuberculata* Yoshiwara; oral side. Natural size.

PLATE 71

FIG 1. *Stereocidaris sceptriferoides* Döderlein, var. *lamellata*, new variety; aboral side. Natural size.

PLATE 72

FIG. 1. *Stereocidaris sceptriferoides* Döderlein, var. *lamellata*, new variety; oral side. Natural size.

PLATE 73

Details of ambulacral structure

FIG. 1. *Rhopalocidaris hirsutispina* (de Meijere), var. *viridis*, new variety. ×12.
2. *Rhopalocidaris hirsutispina* (de Meijere), var. *viridis*, new variety. ×30.
3. *Psilocidaris echinulata*, new species. ×12.
4. *Psilocidaris echinulata*, new species. ×30.
5. *Goniocidaris* (*Cyrtocidaris*) *tenuispina*, new species. ×12.
6. *Goniocidaris* (*Cyrtocidaris*) *tenuispina*, new species. ×30.
7. *Goniocidaris* (*Cyrtocidaris*) *tenuispina*, var. *tuberculata*, new variety. ×12.
8. *Goniocidaris* (*Cyrtocidaris*) *tenuispina*, var. *tuberculata*, new variety. ×30.

PLATE 74

Details of ambulacral structure

FIG. 1. *Schizocidaris serrata* Mortensen. ×12.
2. *Schizocidaris serrata* Mortensen. ×30.
3. *Schizocidaris fasciata*, new species. ×30.
4. *Goniocidaris* (*Discocidaris*) *peltata*, new species. ×12.
5. *Goniocidaris* (*Discocidaris*) *peltata*, new species. ×30.
6. *Stylocidaris reini* (Döderlein), var. *rubida*, new variety. ×12.
7. *Stylocidaris reini* (Döderlein), var. *rubida*, new variety. ×30.
8. *Stereocidaris sceptiferoides* Döderlein, var. *lamellata*, new variety. ×12.
9. *Stereocidaris sceptiferoides* Döderlein, var. *lamellata*, new variety. ×30.

PLATE 75

Details of ambulacral structure

FIGS. 1–2. *Stylocidaris effluens*, new species. ×12.
3. *Stylocidaris annulosa*, new species. ×12.
4. *Stylocidaris reini* (Döderlein), var. *cladothrix*, new variety. ×12.

PLATE 76

FIGS. 1–2. Scrobicular spines of *Histocidaris magnifica*, new species. ×12.
3. Valve of tridentate pedicellaria of *Histocidaris magnifica*, new species. ×38.

PLATE 77

Pedicellariae, and a scrobicular spine

FIG. 1. Valve of tridentate pedicellaria, large form, of *Histocidaris elegans* (A. Agassiz). ×38.
2. Valve of tridentate pedicellaria, small form, of *Histocidaris elegans* (A. Agassiz) (specimen from station 5450). ×65.
3. Valve of tridentate pedicellaria, large form, of *Histocidaris elegans* (A. Agassiz) (specimen from station 5450). ×38.
4. Valve of tridentate pedicellaria, large form, of *Histocidaris acutispina*, new species. ×38.
5. Valve of tridentate pedicellaria, large form, of *Histocidaris*, species. ×38.
6–7. Valve of tridentate pedicellaria, small form, of *Histocidaris*, species. ×65.
8. Scrobicular spine of *Histocidaris*, species. ×12.

Plate 78

Pedicellariae, spines and hairs

Fig. 1. Valve of small globiferous pedicellaria of *Schizocidaris serrata* (Mortensen). ×120.

2. Valve of small globiferous pedicellaria of *Schizocidaris fasciata*, new species. ×120.

3–5. Valves of small globiferous pedicellaria of *Psilocidaris echinulata*, new species. ×100. (Fig. 4 from a very elongate form, resembling a tridentate pedicellaria.)

6. Secondary spine of *Rhopalocidaris hirsutispina* (de Meijere), var. *viridis*, new variety. ×50.

7. Valve of small globiferous pedicellaria of *Rhopalocidaris hirsutispina* (de Meijere), var. *viridis*, new variety. ×120.

8*a*–*b*. Hairs from primary spine of *Rhopalocidaris hirsutispina* (de Meijere var. *viridis*, new variety. ×50.

9. Valve of large globiferous pedicellaria of *Goniocidaris* (*Discocidaris*) *peltata*, new species. ×70.

10–11. Valves of small globiferous pedicellariae of *Goniocidaris* (*Discocidaris*) *peltata*, new species. × 70.

12. Scrobicular spine of *Goniocidaris* (*Discocidaris*) *peltata*, new species. ×30

13. Valve of small globiferous pedicellaria of *Stereocidaris sceptriferoides* Döderlein, var. *lamellata*, new variety. ×100.

14. Valve of large globiferous pedicellaria of *Stereocidaris sceptiferoides* Döderlein, var. *lamellata*, new variety. ×100. The end tooth is only apparently single; in reality it is composed of two lateral teeth so closely appressed as to appear like an unpaired terminal tooth.

PLATE 79

Pedicellariae

Fig. 1. Valve of tridentate pedicellaria of *Goniocidaris* (*Cyrtocidaris*) *tenuispina*, new species. ×95.

2–3. Valves of small globiferous pedicellariae of *Goniocidaris* (*Cyrtocidaris*) *tenuispina*, new species. ×95.

4–6. Valves of various forms of small globiferous pedicellariae of *Goniocidaris* (*Cyrtocidaris*) *tenuispina*, new species, var. *tuberculata*, new variety. ×95.

7. Large tridentate pedicellaria of *Goniocidaris* (*Cyrtocidaris*) *tenuispina*, new species, var. *tuberculata*, new variety. ×50.

8. Valve of same. ×50.

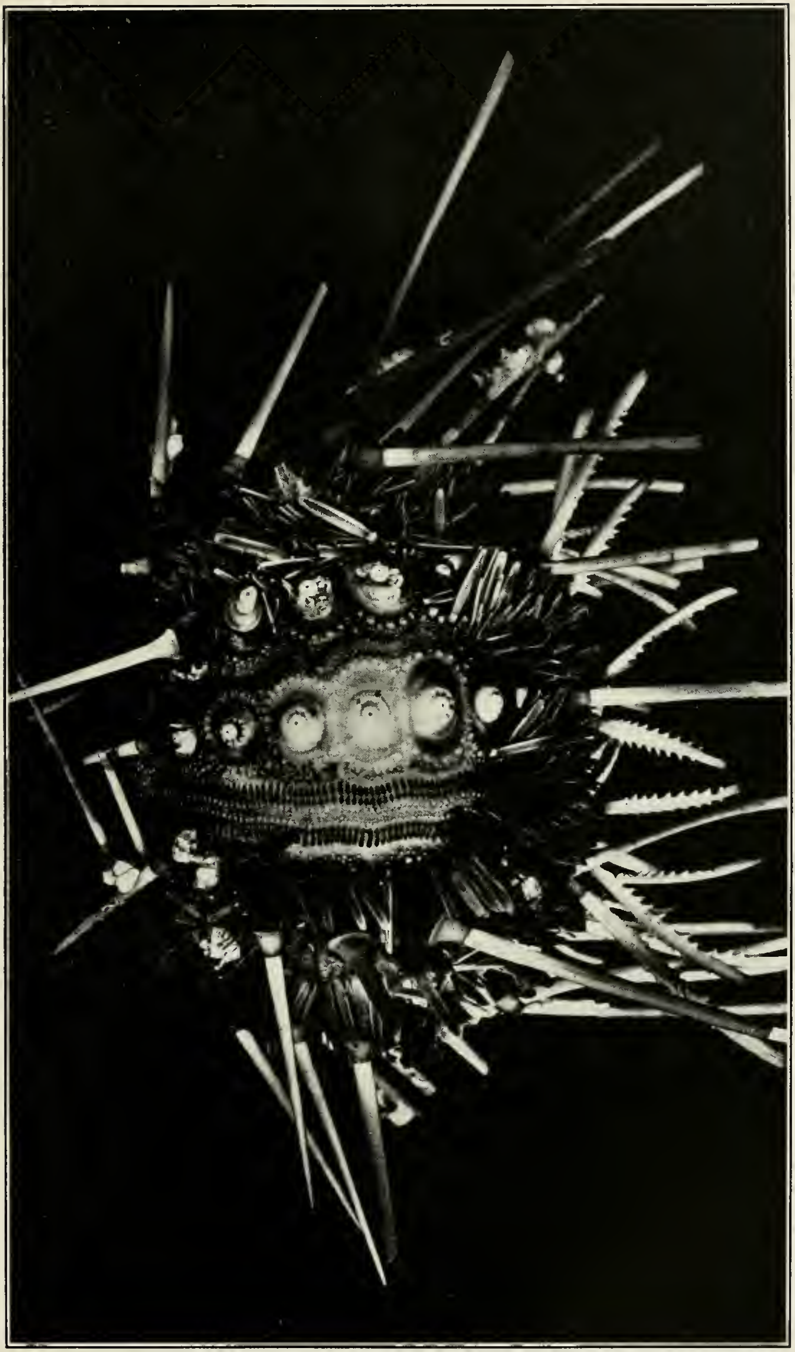
9. Valve of large globiferous pedicellaria of *Goniocidaris* (*Cyrtocidaris*) *tenuispina*, new species, var. *major*, new variety. ×70.

Plate 80

Pedicellariae, spines, and spicules

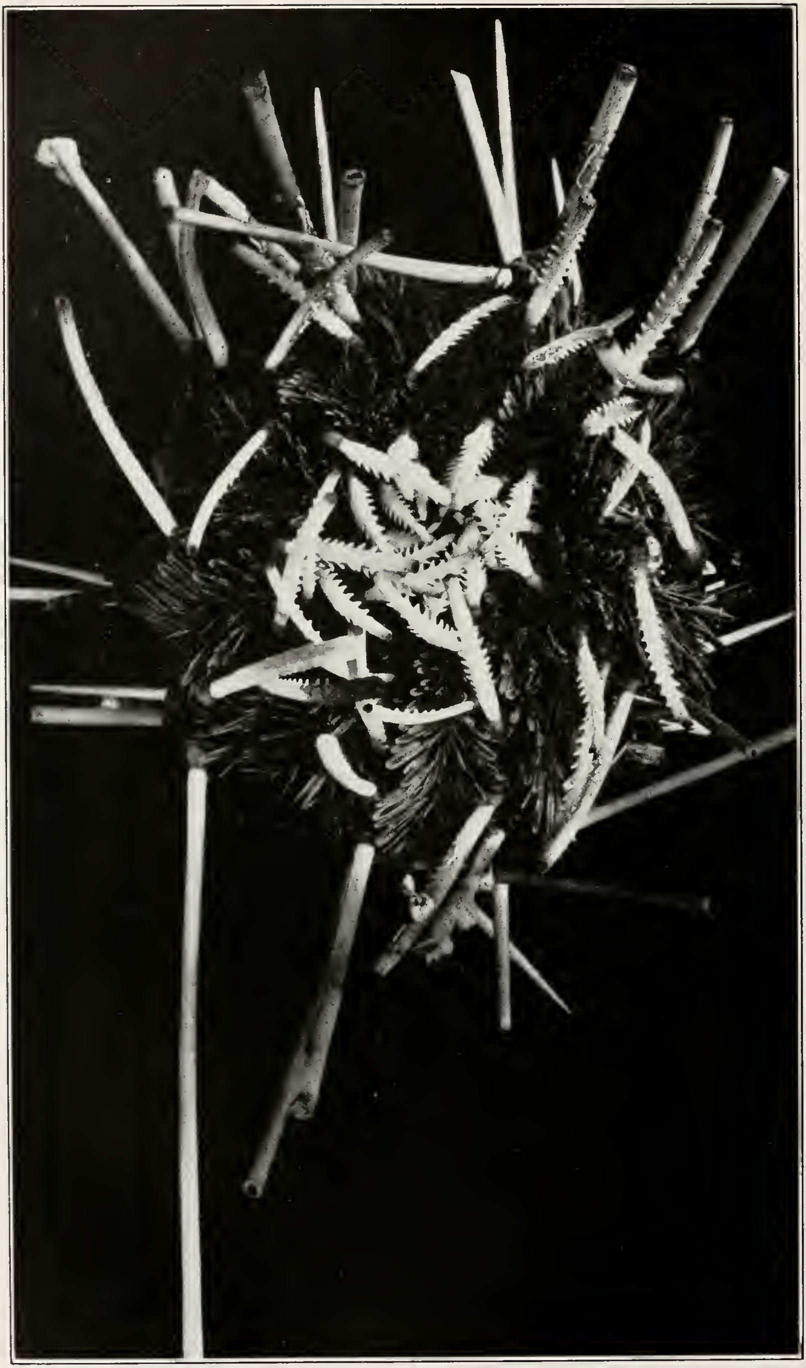
Fig. 1. Short-stalked form of small globiferous pedicellaria of *Stylocidaris effluens*, new species. ×70.
2–3. Valves of same form. ×100.
4. Valve of large globiferous pedicellaria of *Stylocidaris effluens*, new species. ×100.
5. Tridentate pedicellaria of *Stylocidaris effluens*, new species. ×50.
6. Valve of usual form of small globiferous pedicellaria of *Stylocidaris effluens*, new species. ×70.
7. Scrobicular spine of *Stylocidaris annulosa*, new species. ×12.
8. Valve of small globiferous pedicellaria of *Stylocidaris annulosa*, new species. ×70.
9. Valve of large globiferous pedicellaria of *Stylocidaris annulosa*, new species. ×70.
10. Valve of tridentate pedicellaria of *Stylocidaris annulosa*, new species. ×50.
11*a*–*b*. Spicules from intestinal wall of *Stylocidaris annulosa*, new species. ×70.

○



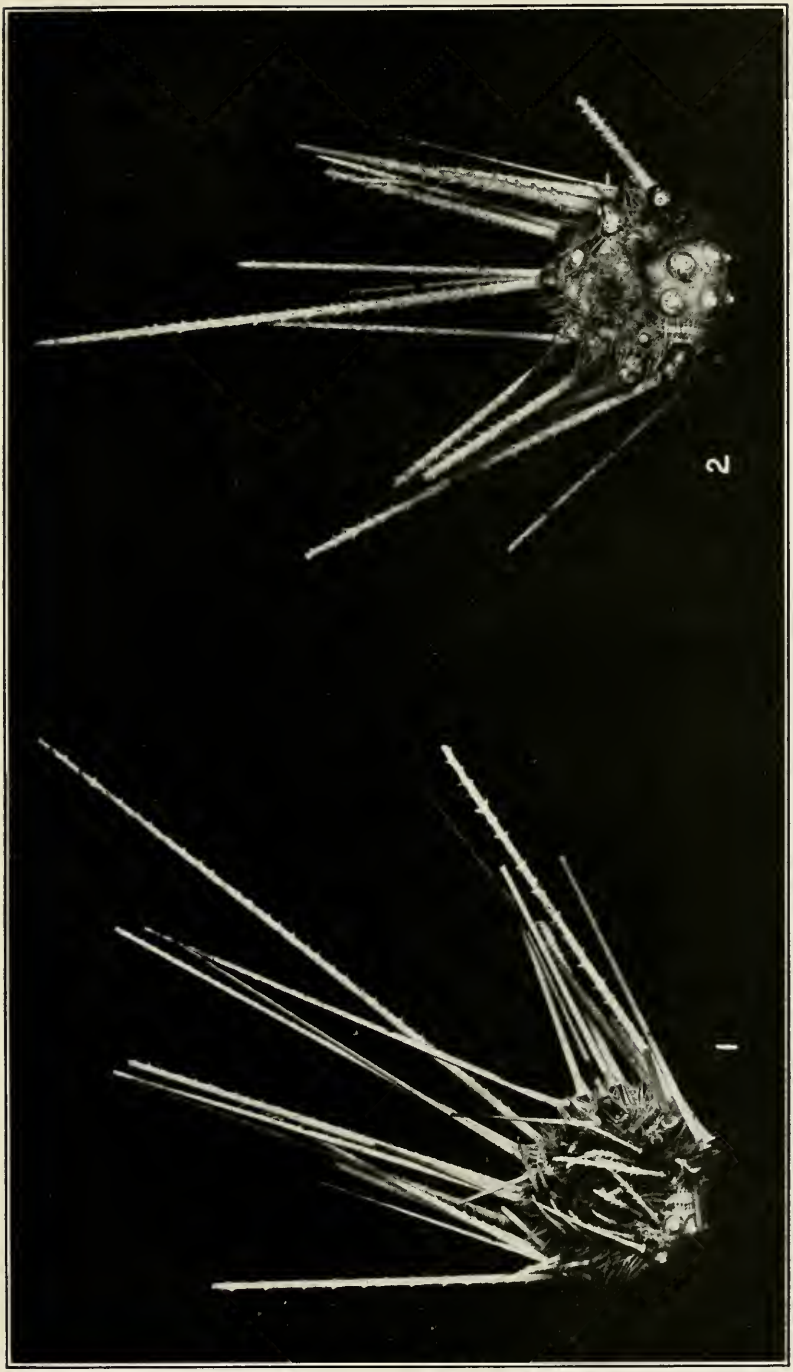
ECHINOIDEA COLLECTED BY THE "ALBATROSS"

FOR EXPLANATION OF PLATE SEE PAGE 307



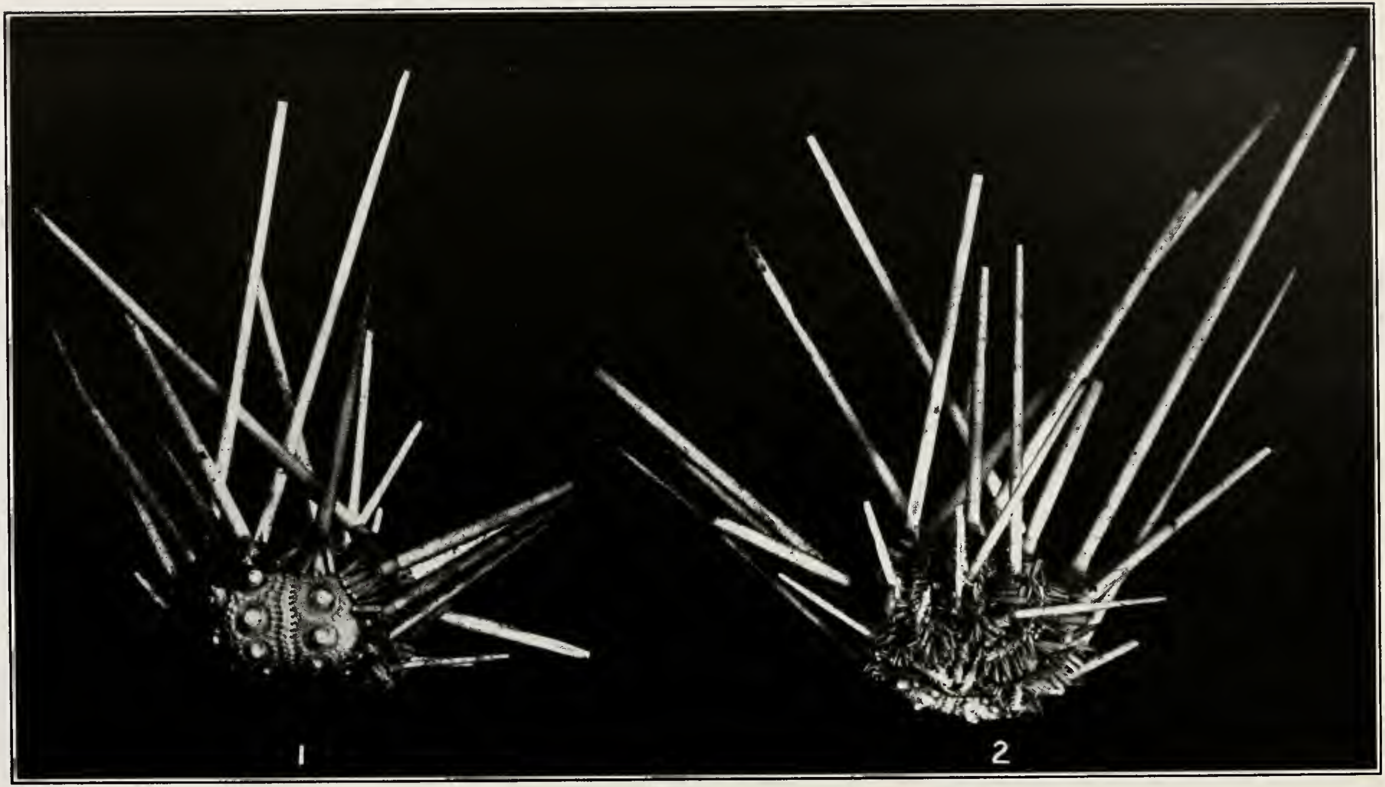
ECHINOIDEA COLLECTED BY THE "ALBATROSS"

FOR EXPLANATION OF PLATE SEE PAGE 307



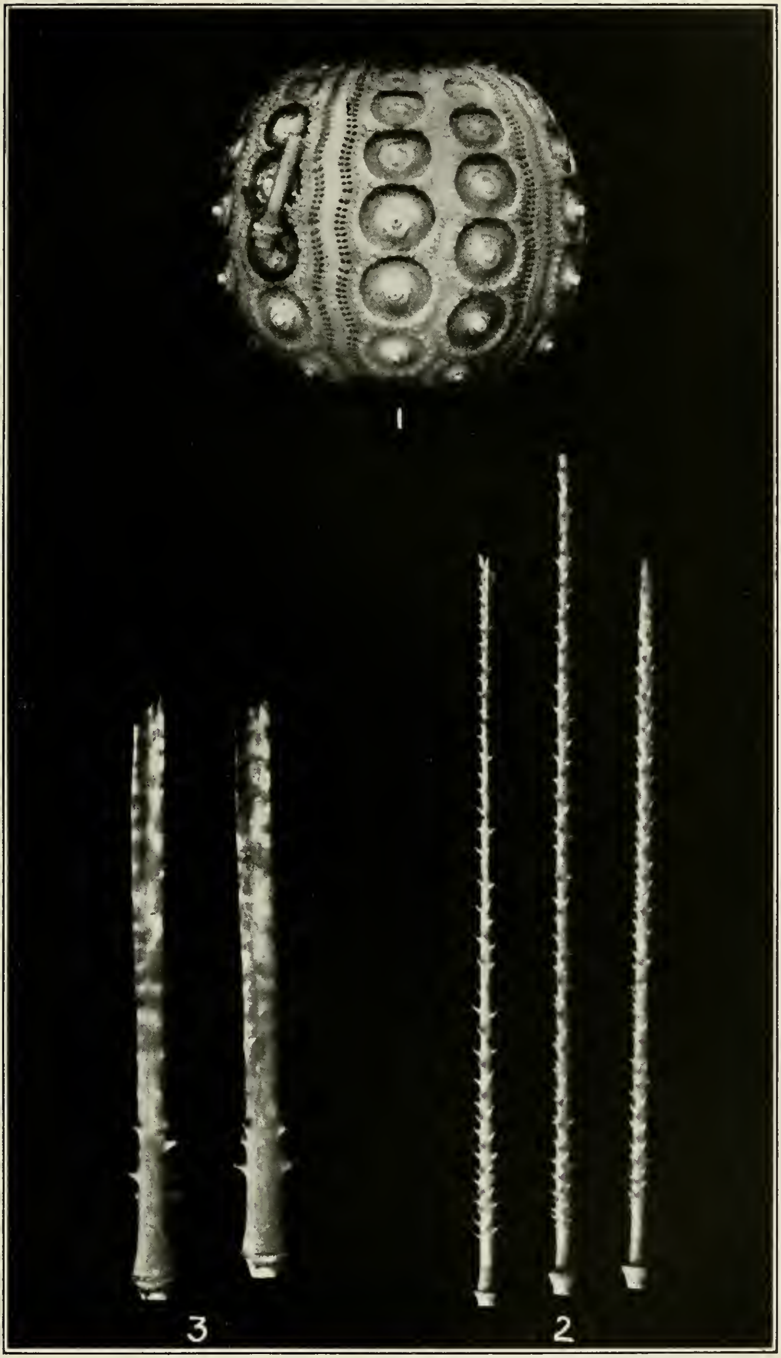
ECHINOIDEA COLLECTED BY THE "ALBATROSS"

FOR EXPLANATION OF PLATE SEE PAGE 307



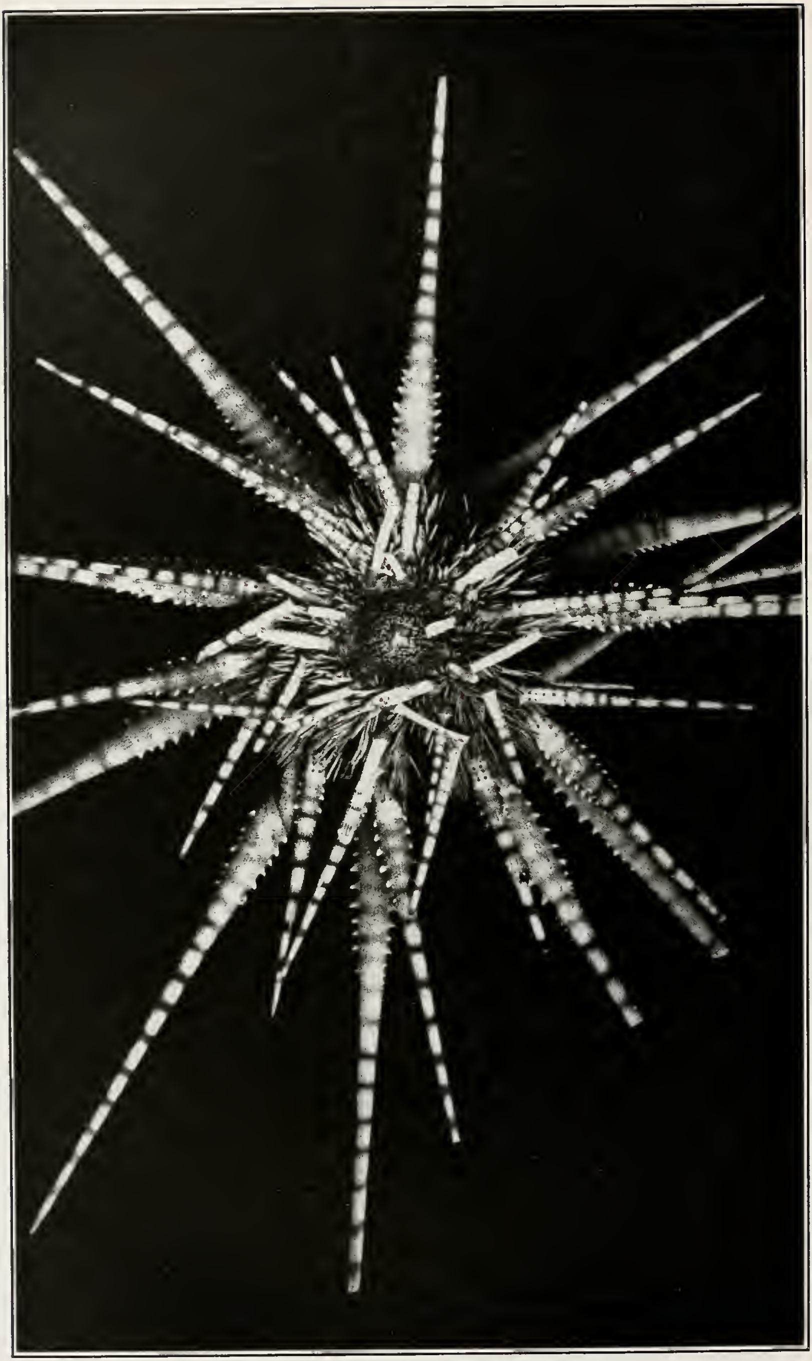
Echinoidea Collected by the "Albatross"

For explanation of plate see page 307



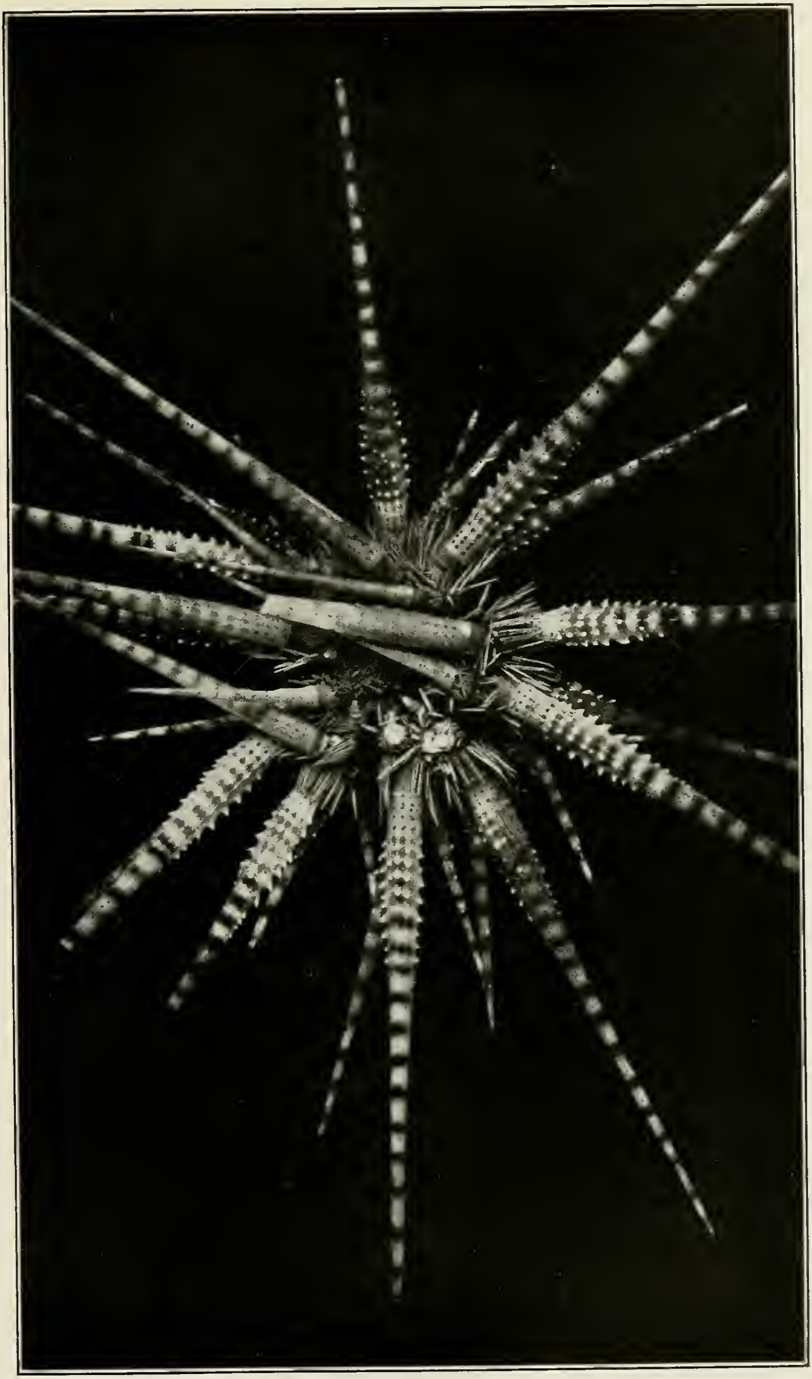
Echinoidea Collected by the "Albatross"

For explanation of plate see page 307



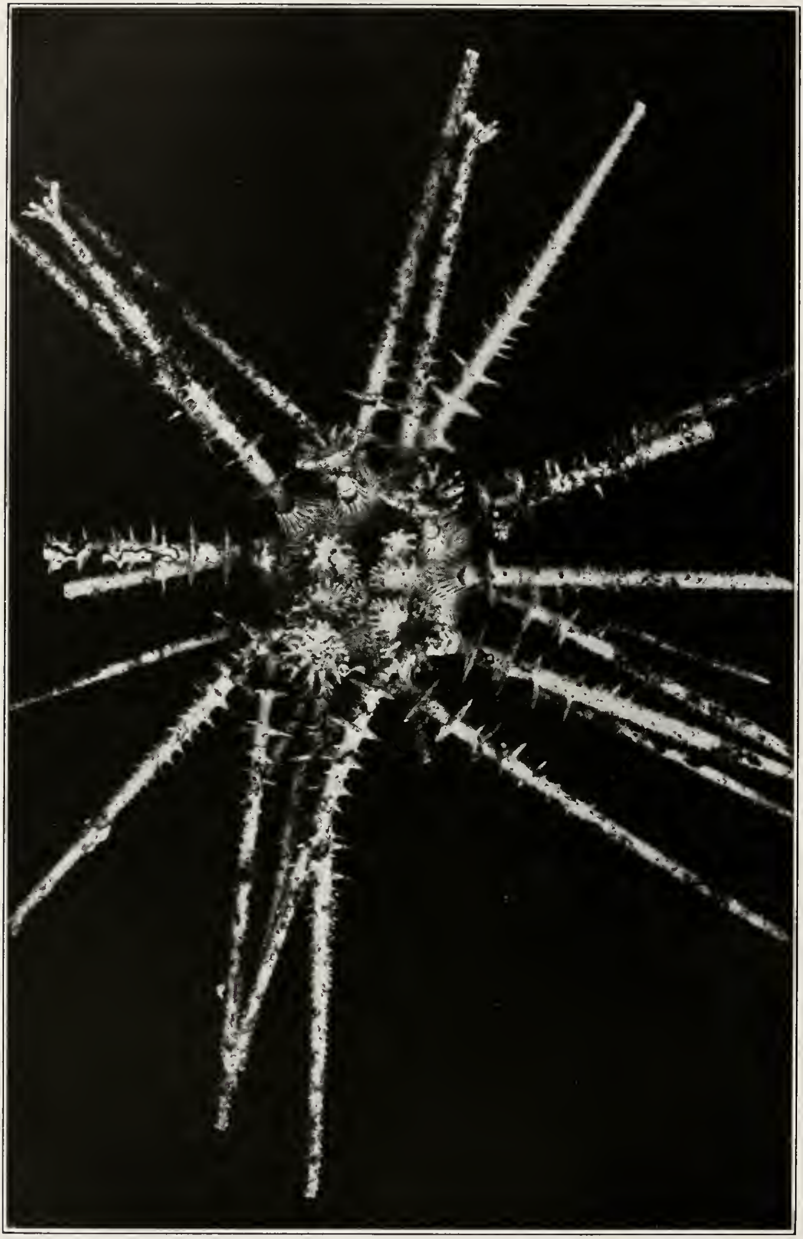
Echinoidea Collected by the "Albatross"

For explanation of plate see page 307



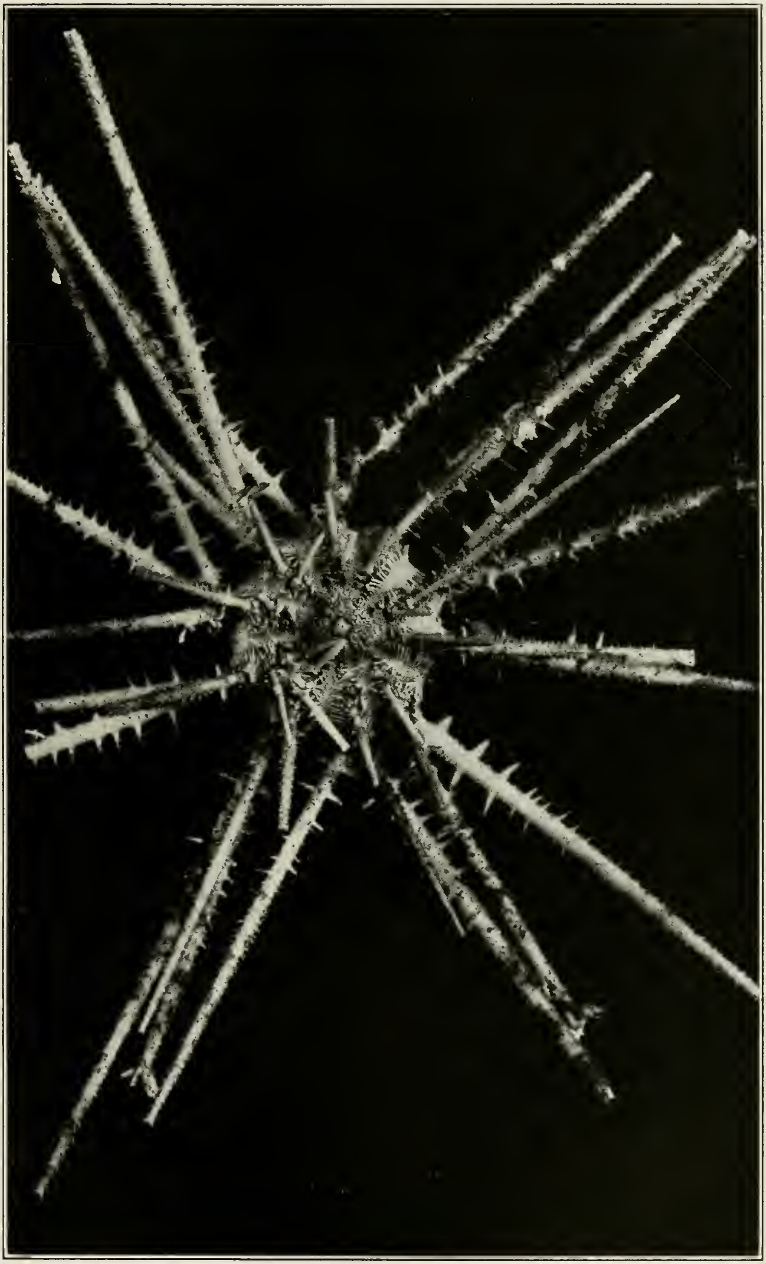
ECHINOIDEA COLLECTED BY THE "ALBATROSS"

FOR EXPLANATION OF PLATE SEE PAGE 307



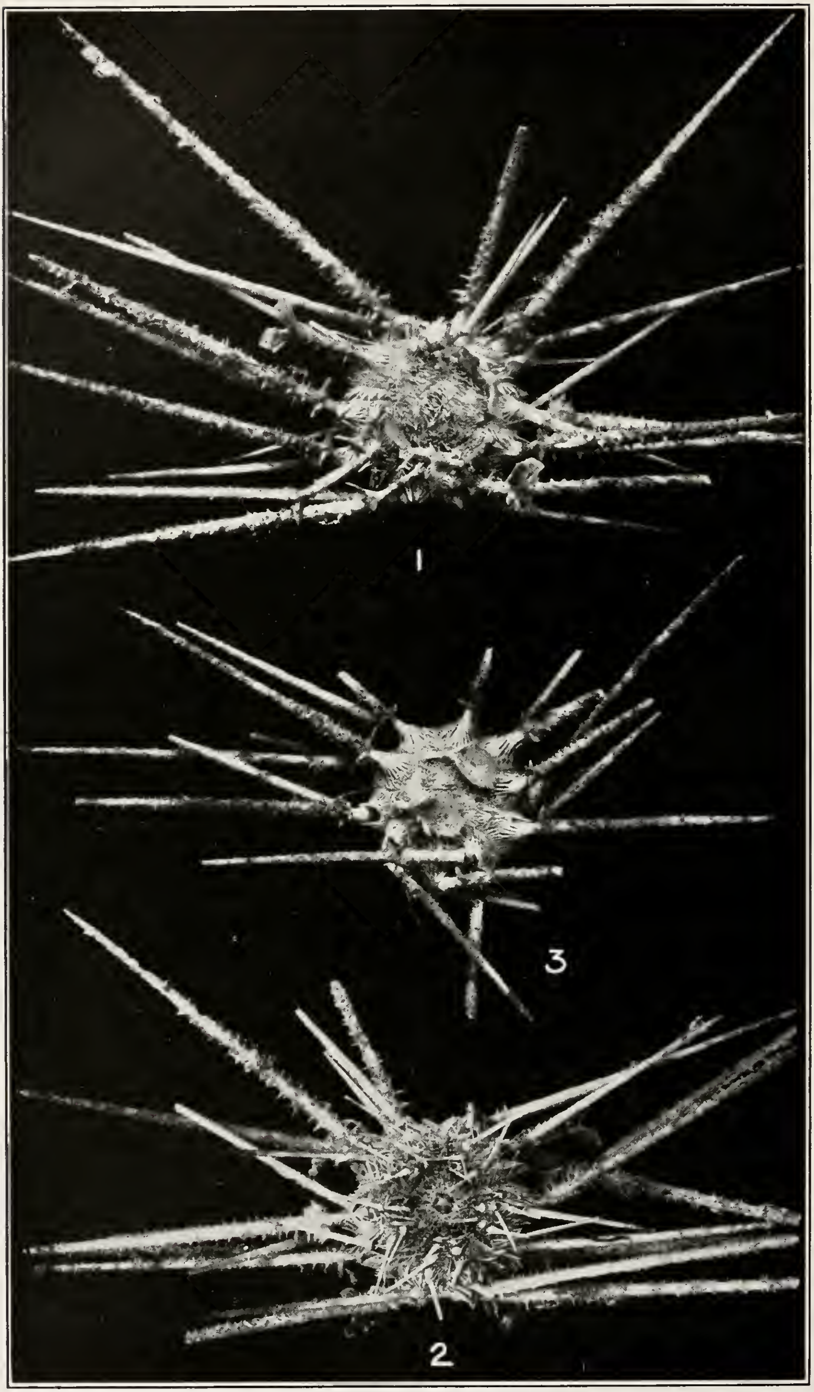
Echinoidea Collected by the "Albatross"

For explanation of plate see page 307



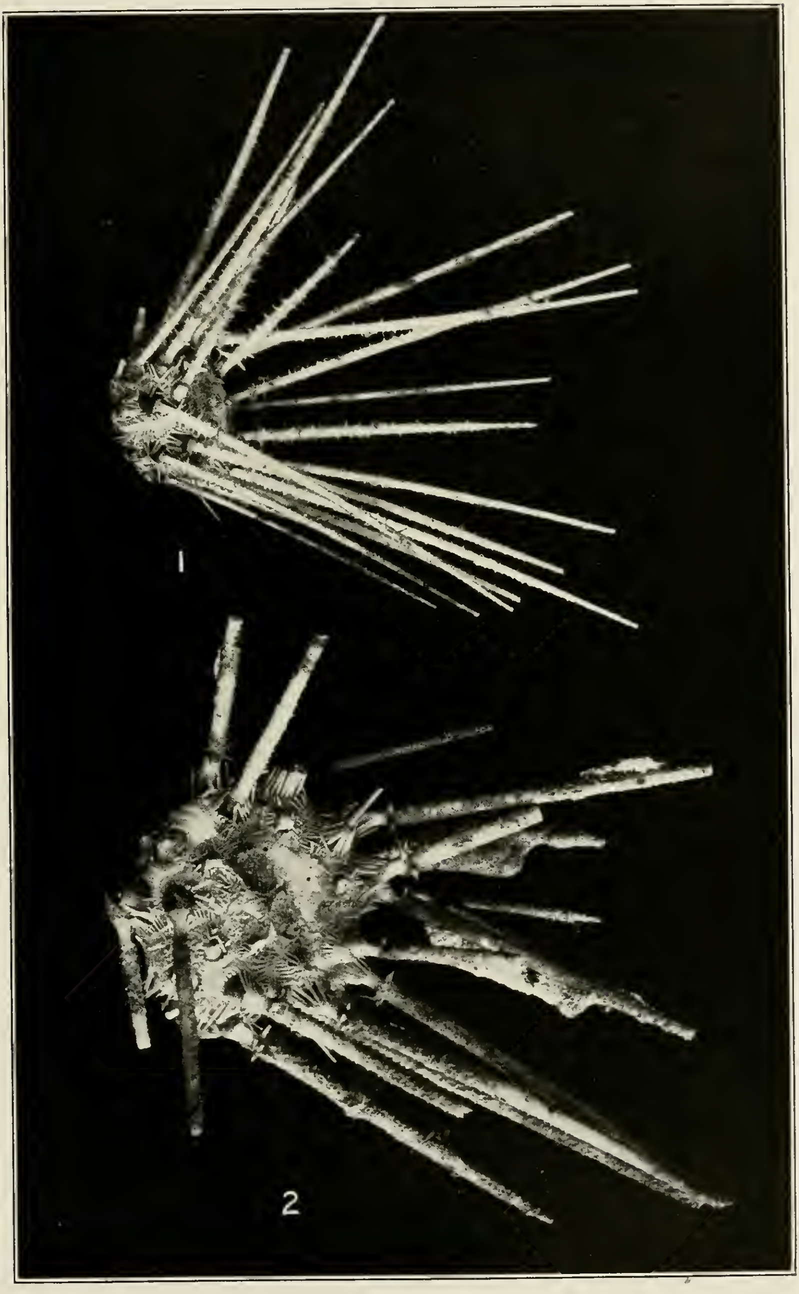
ECHINOIDEA COLLECTED BY THE "ALBATROSS"

FOR EXPLANATION OF PLATE SEE PAGE 307



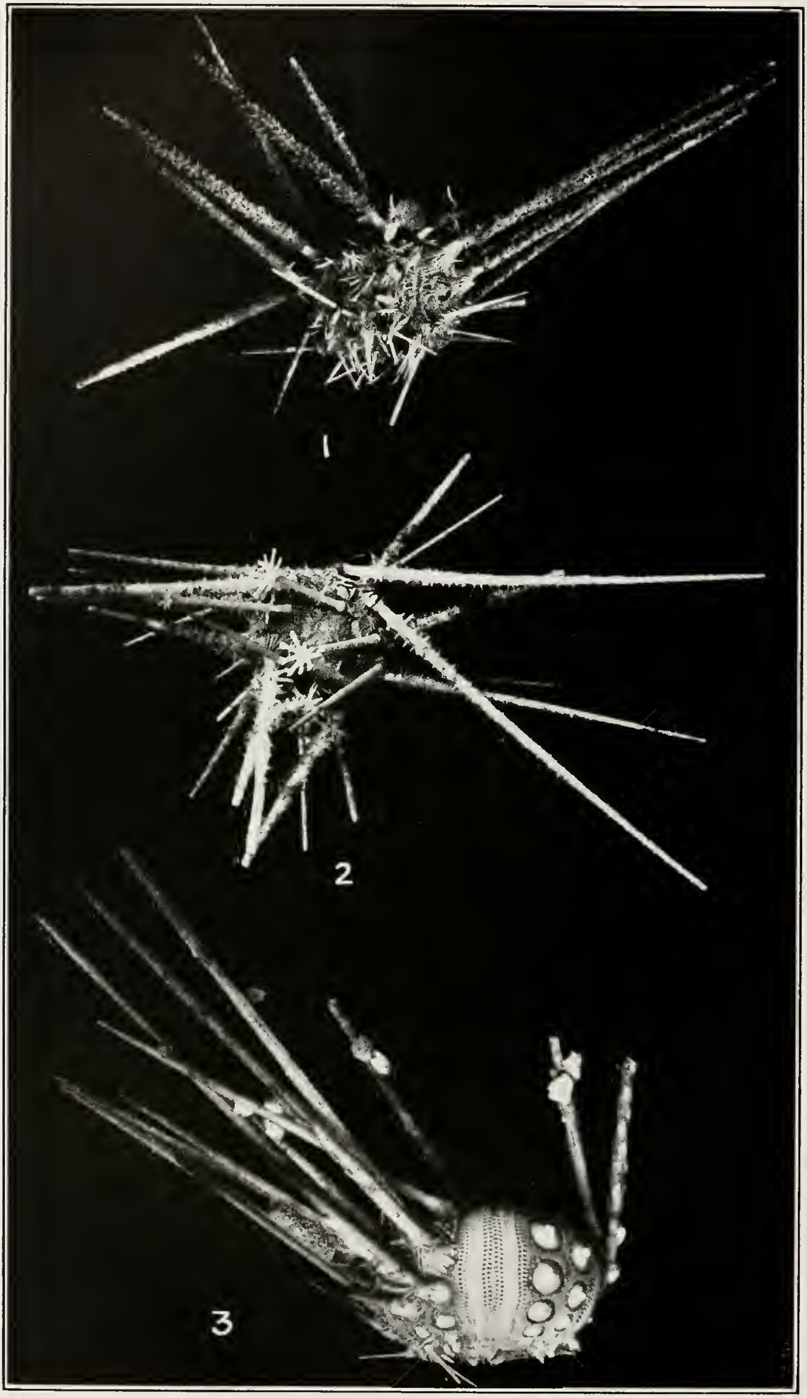
Echinoidea Collected by the "Albatross"

For explanation of plate see page 307



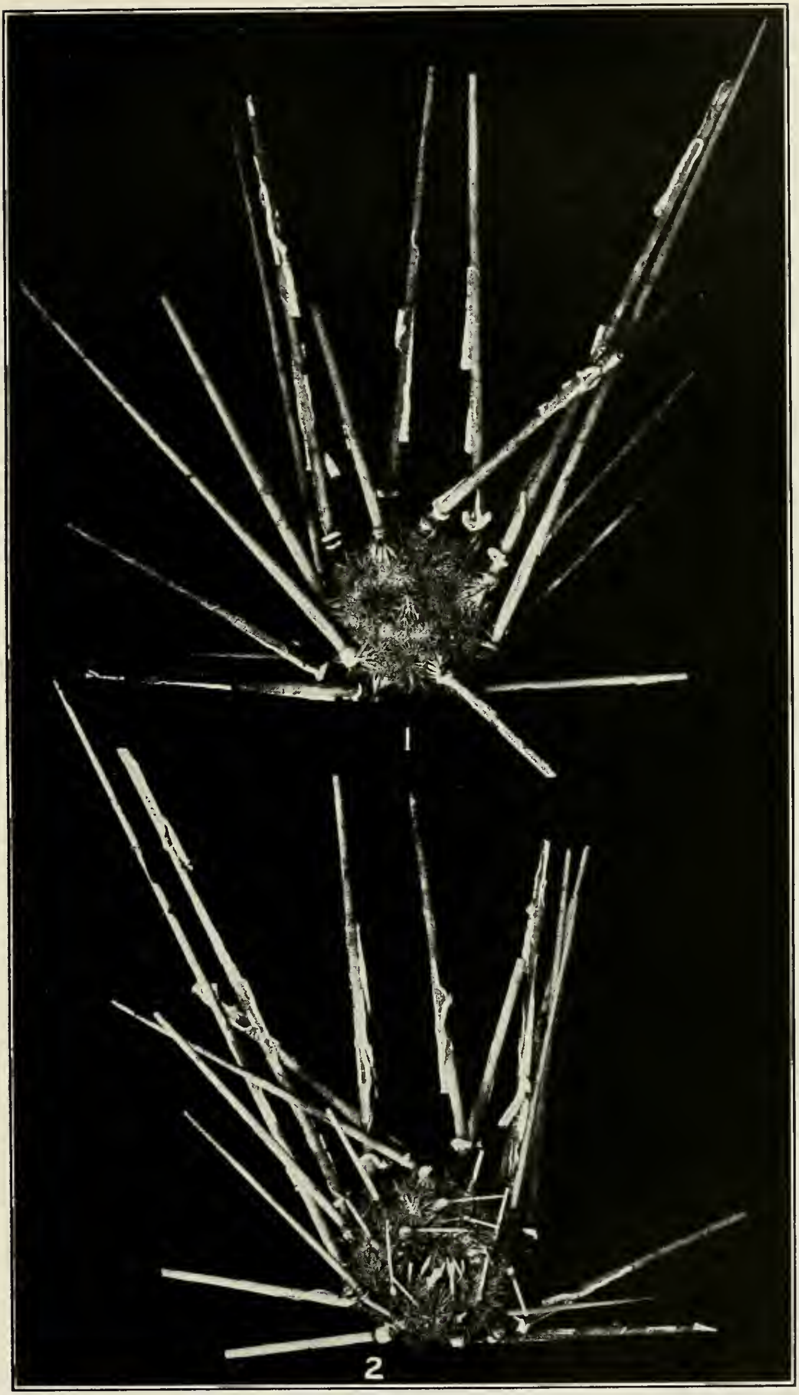
Echinoidea Collected by the "Albatross"

For explanation of plate see page 308



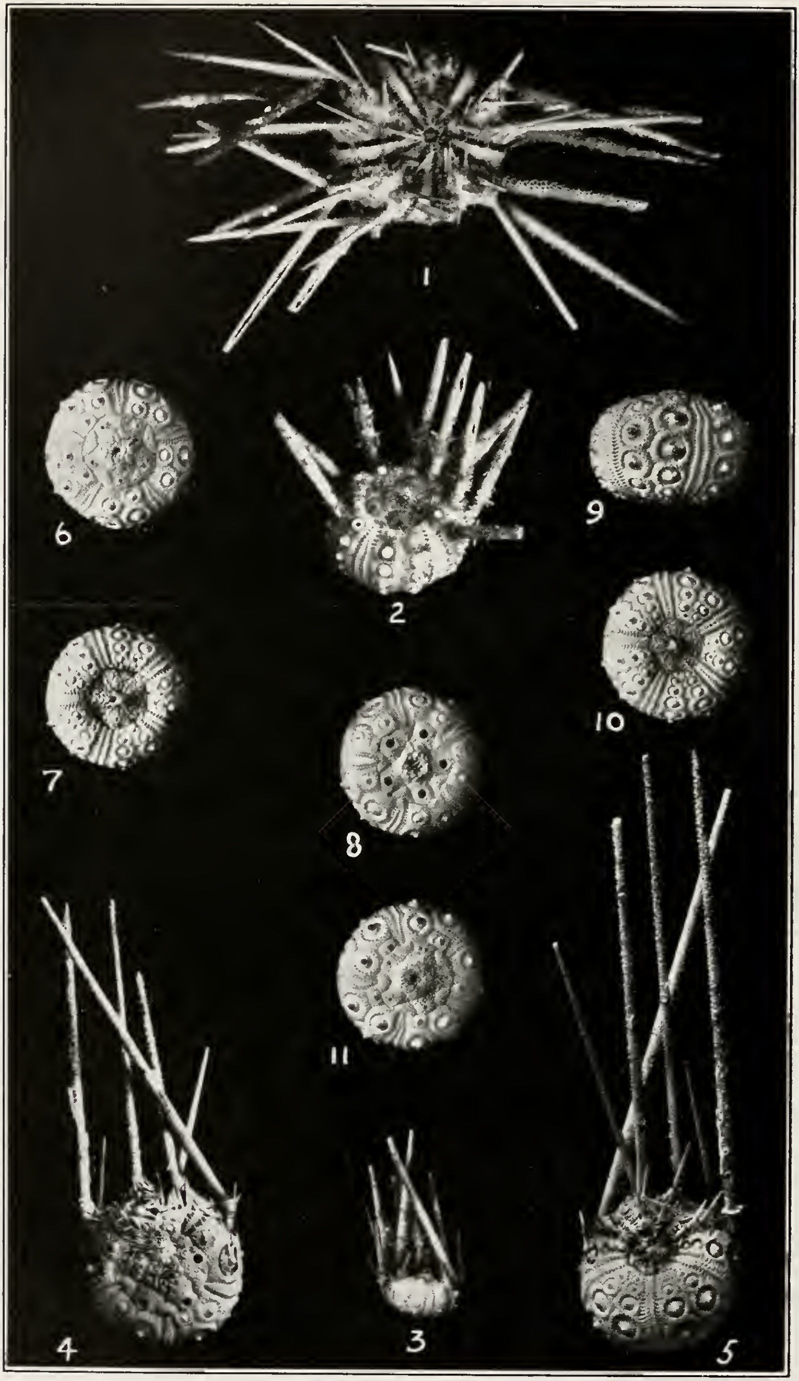
Echinoidea Collected by the "Albatross"

For explanation of plate see page 303



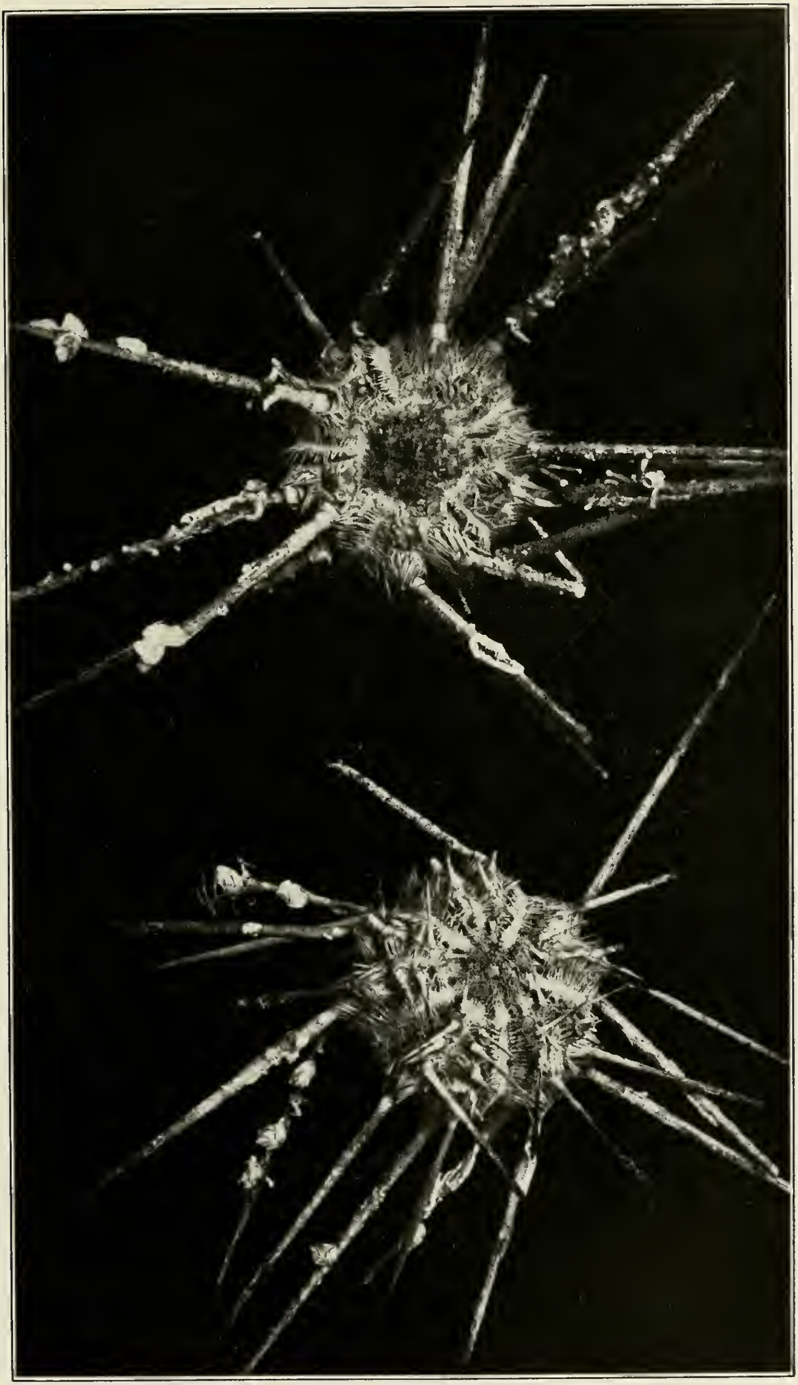
ECHINOIDEA COLLECTED BY THE "ALBATROSS"

FOR EXPLANATION OF PLATE SEE PAGE 308


1
6
2
9
7
10
8
11
4
3
5

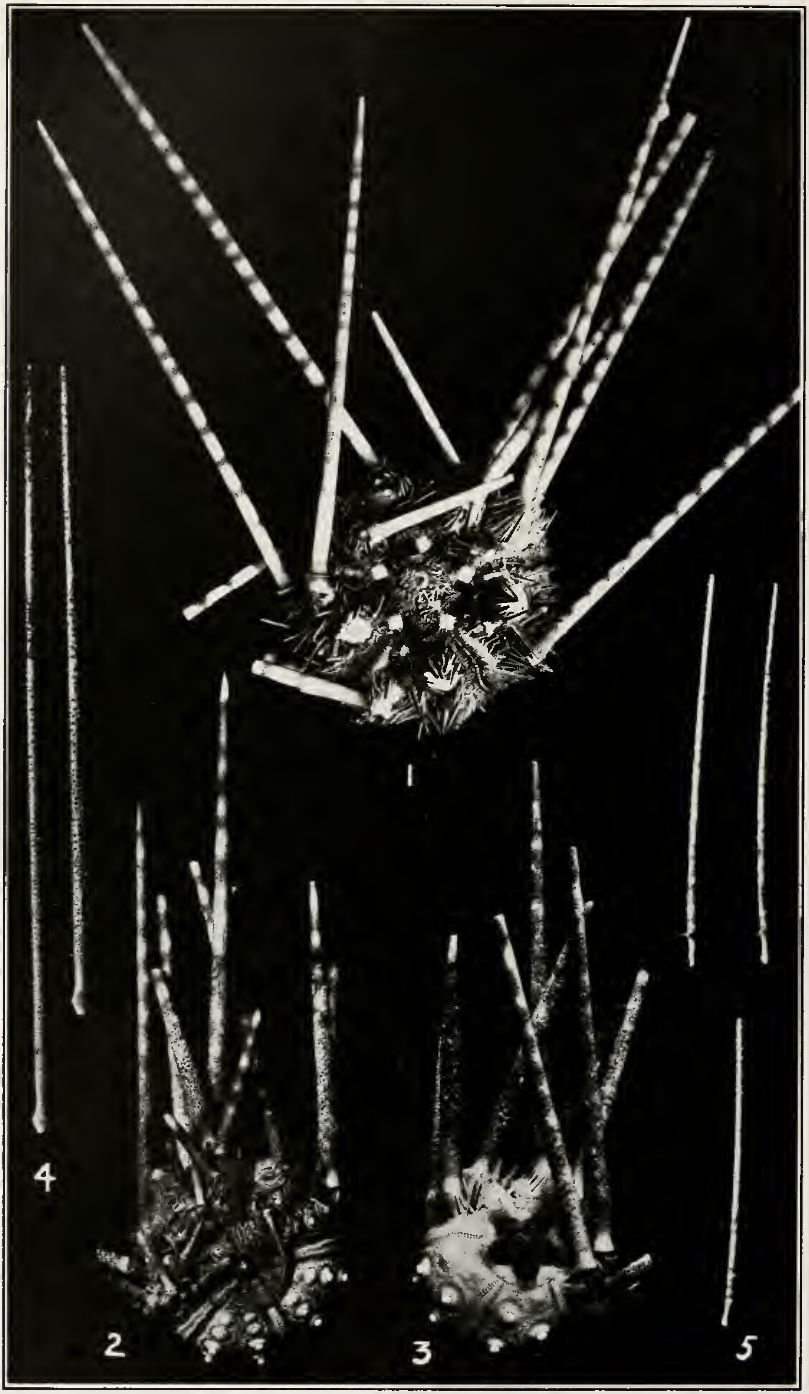
ECHINOIDEA COLLECTED BY THE "ALBATROSS"

FOR EXPLANATION OF PLATE SEE PAGE 308



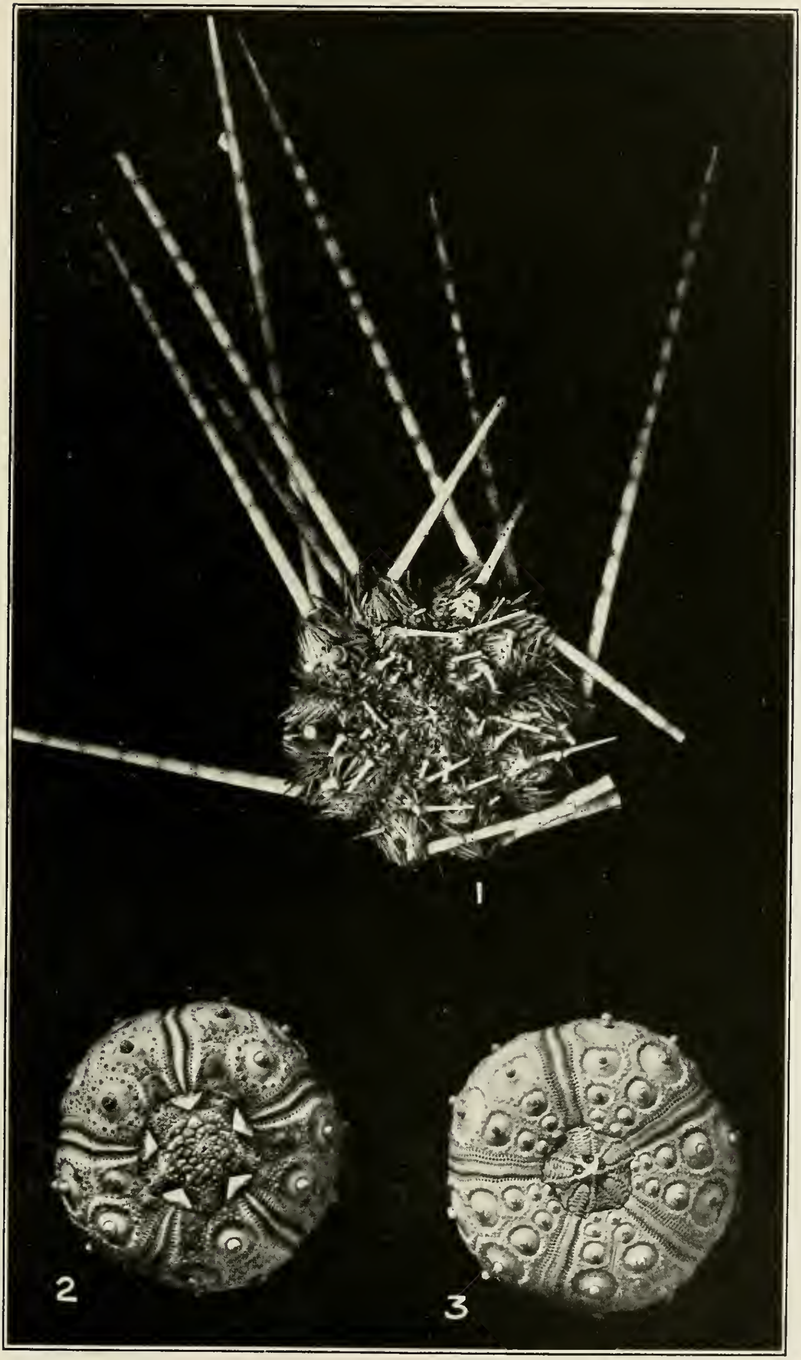
Echinoidea Collected by the "Albatross"

For explanation of plate see page 308



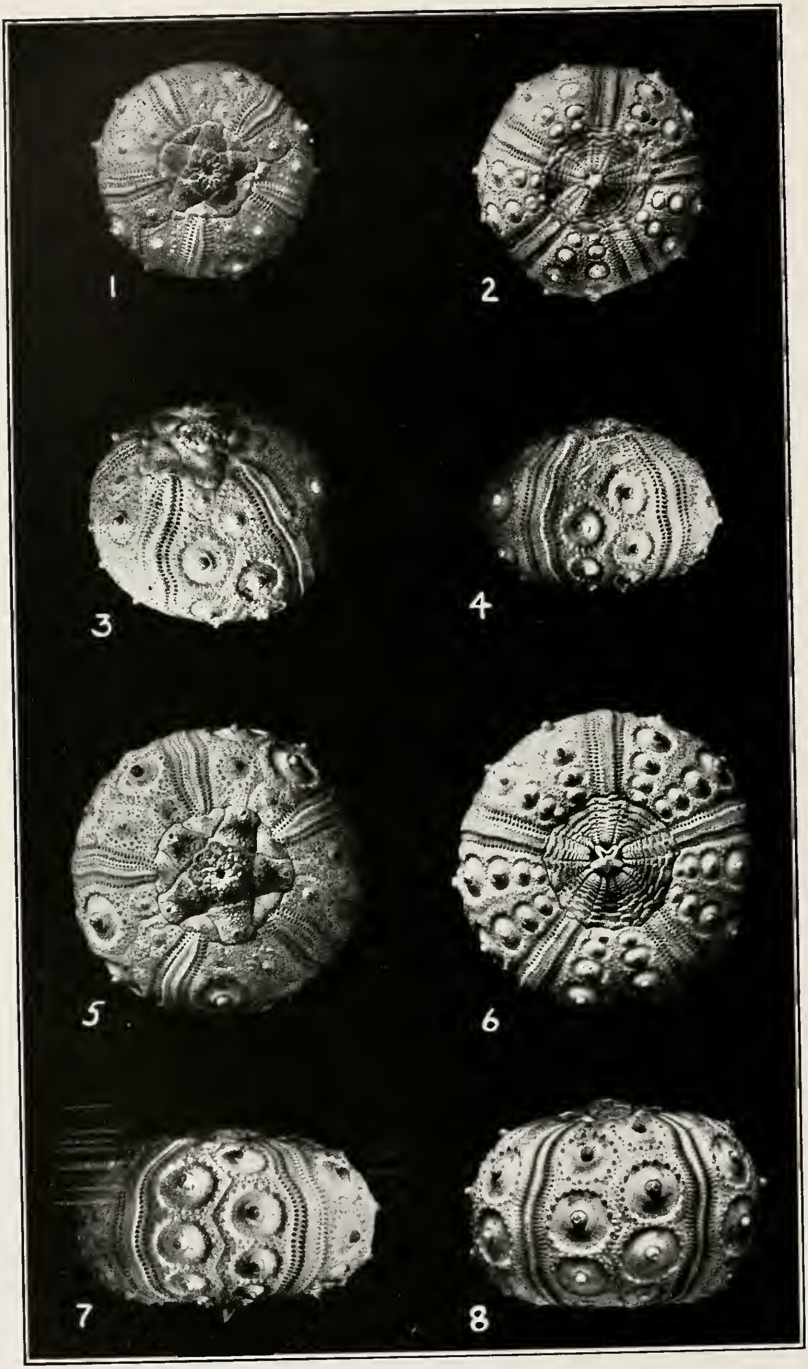
ECHINOIDEA COLLECTED BY THE "ALBATROSS"

FOR EXPLANATION OF PLATE SEE PAGE 303



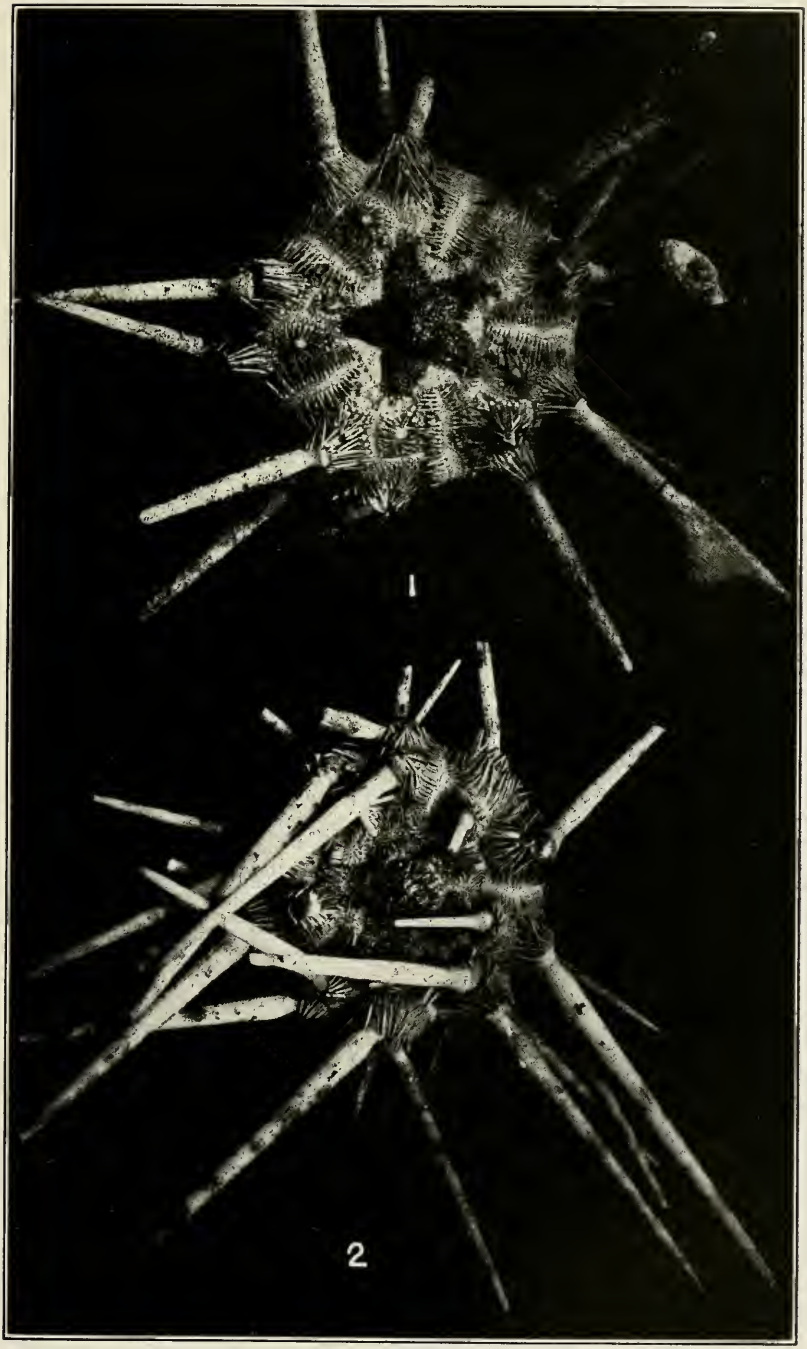
Echinoidea Collected by the "Albatross"

For explanation of plate see page 309



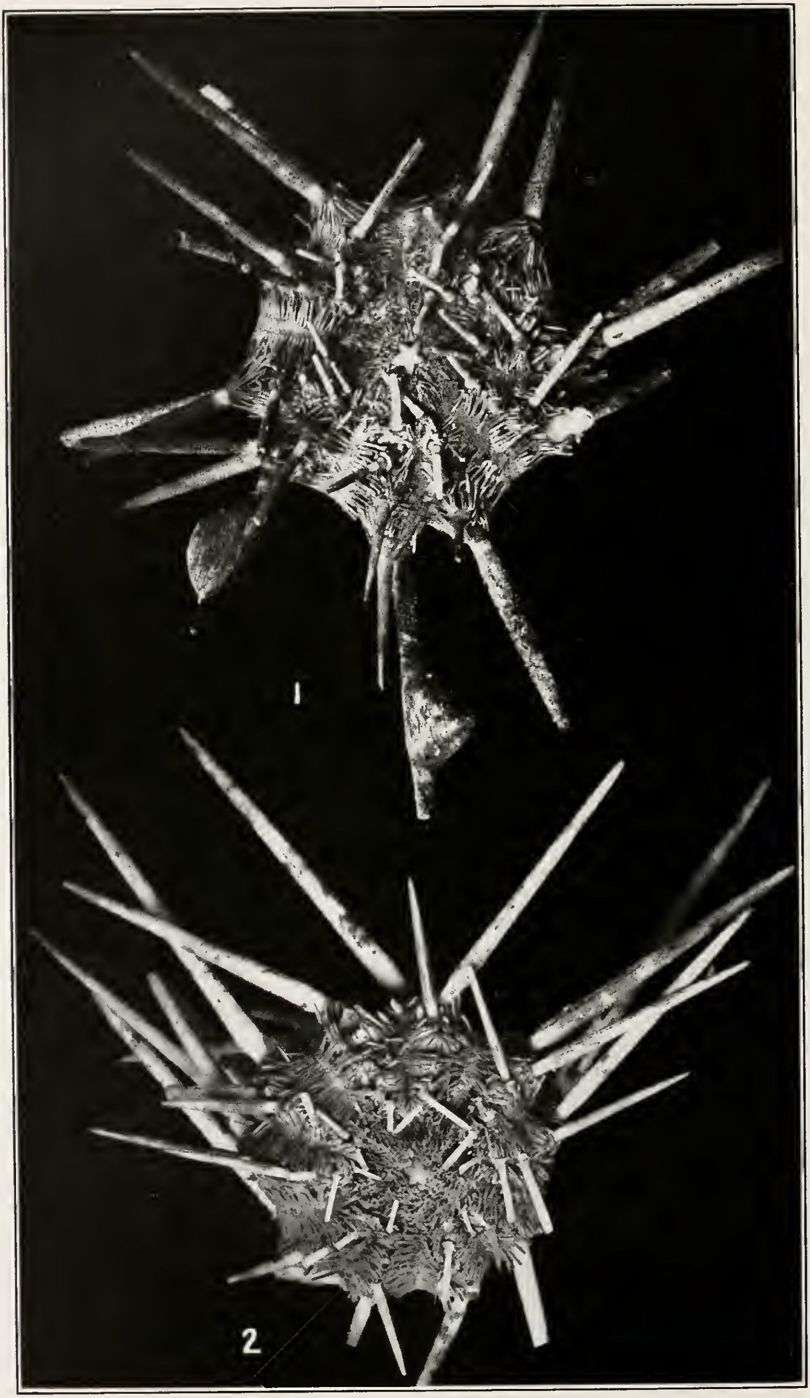
ECHINOIDEA COLLECTED BY THE "ALBATROSS"

FOR EXPLANATION OF PLATE SEE PAGE 309



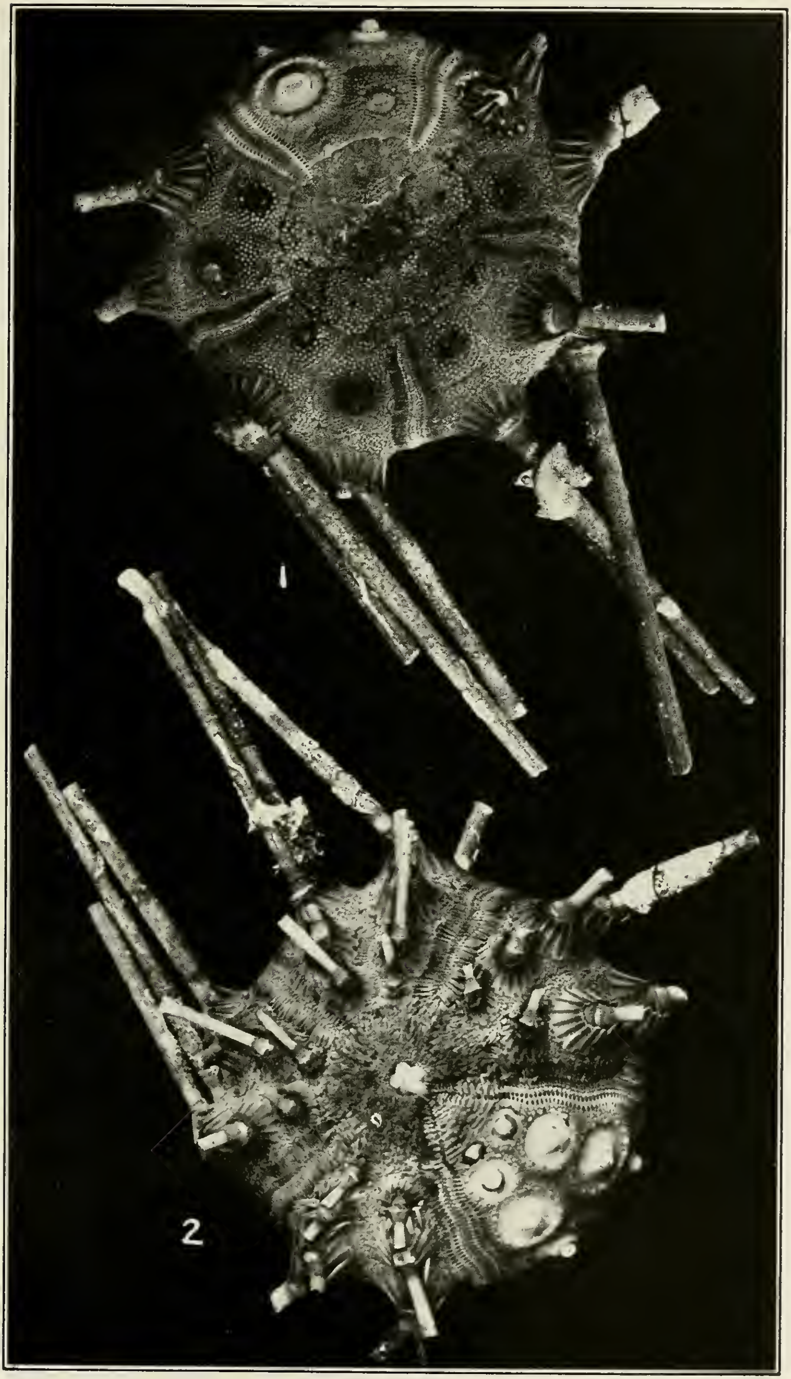
ECHINOIDEA COLLECTED BY THE "ALBATROSS"

FOR EXPLANATION OF PLATE SEE PAGE 309



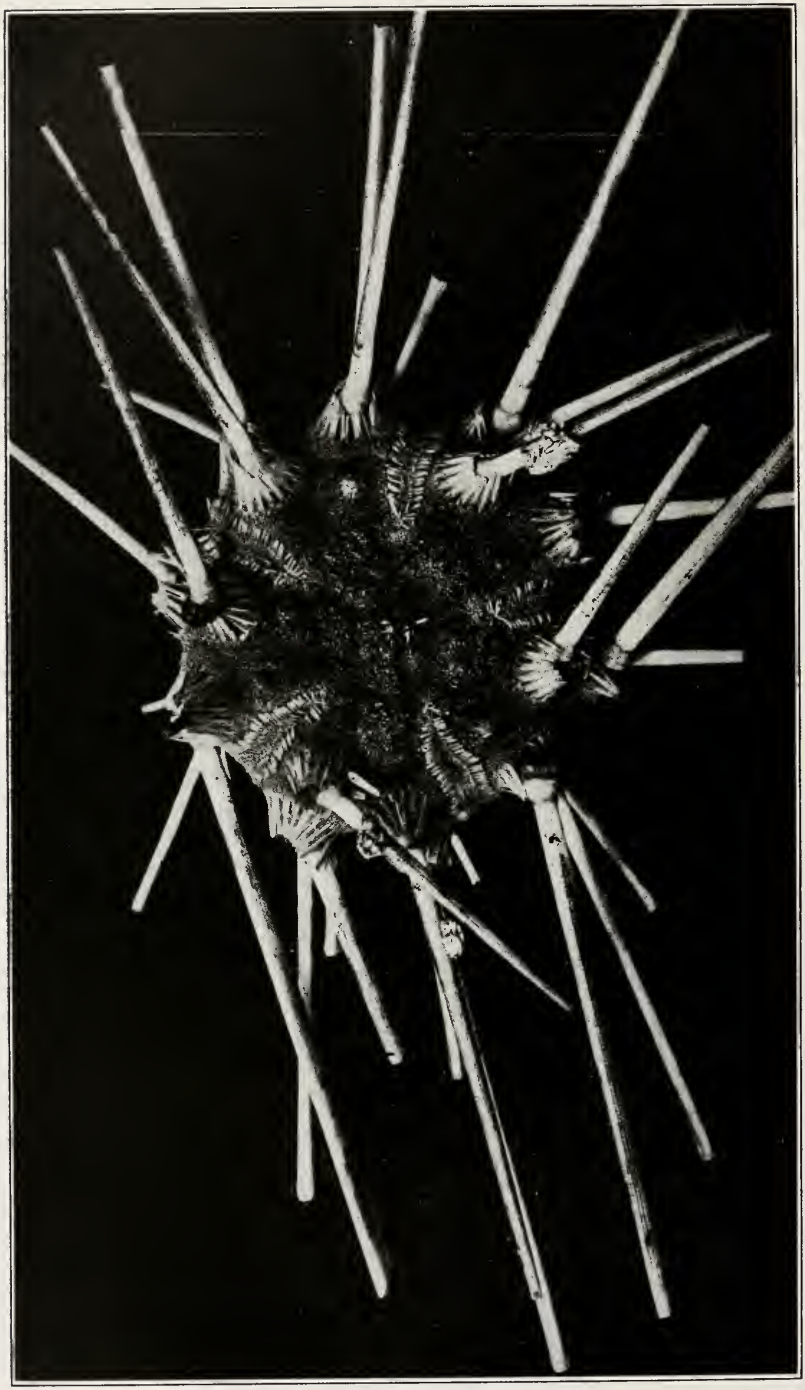
Echinoidea Collected by the "Albatross"

For explanation of plate see page 309



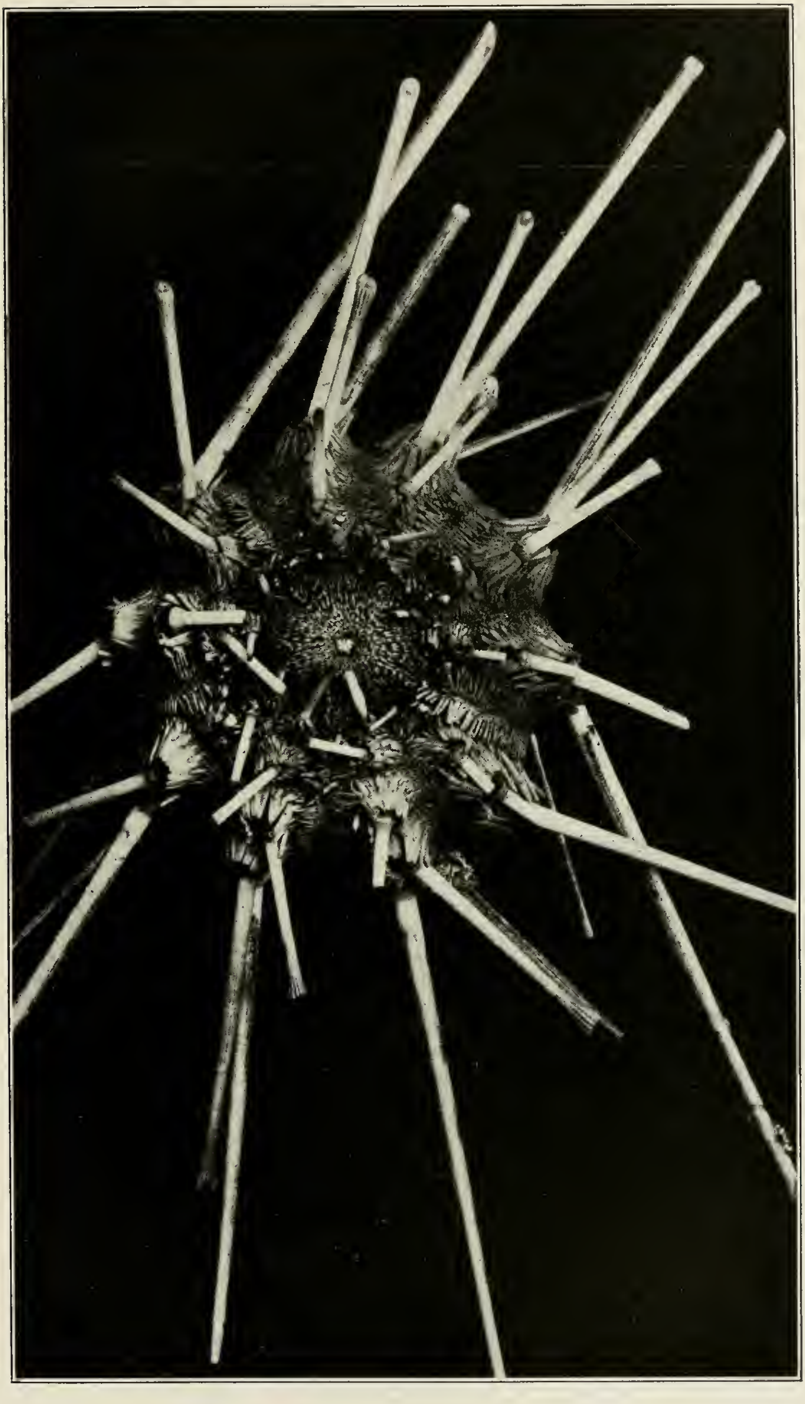
ECHINOIDEA COLLECTED BY THE "ALBATROSS"

FOR EXPLANATION OF PLATE SEE PAGE 309



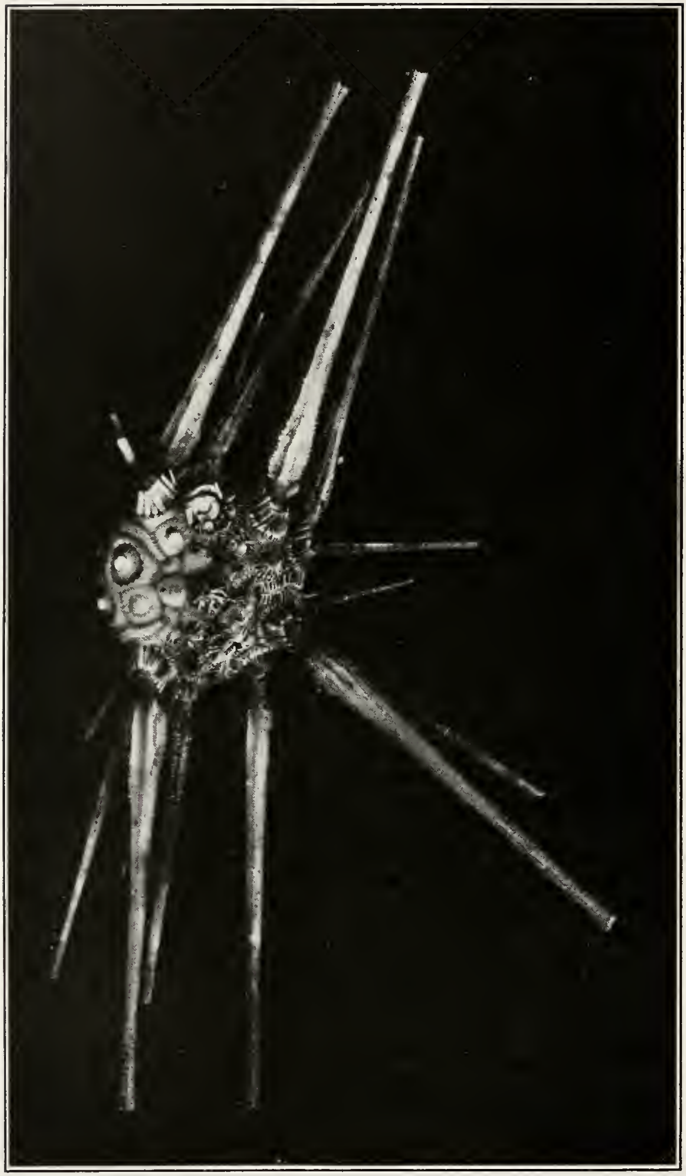
ECHINOIDEA COLLECTED BY THE "ALBATROSS"

FOR EXPLANATION OF PLATE SEE PAGE 309



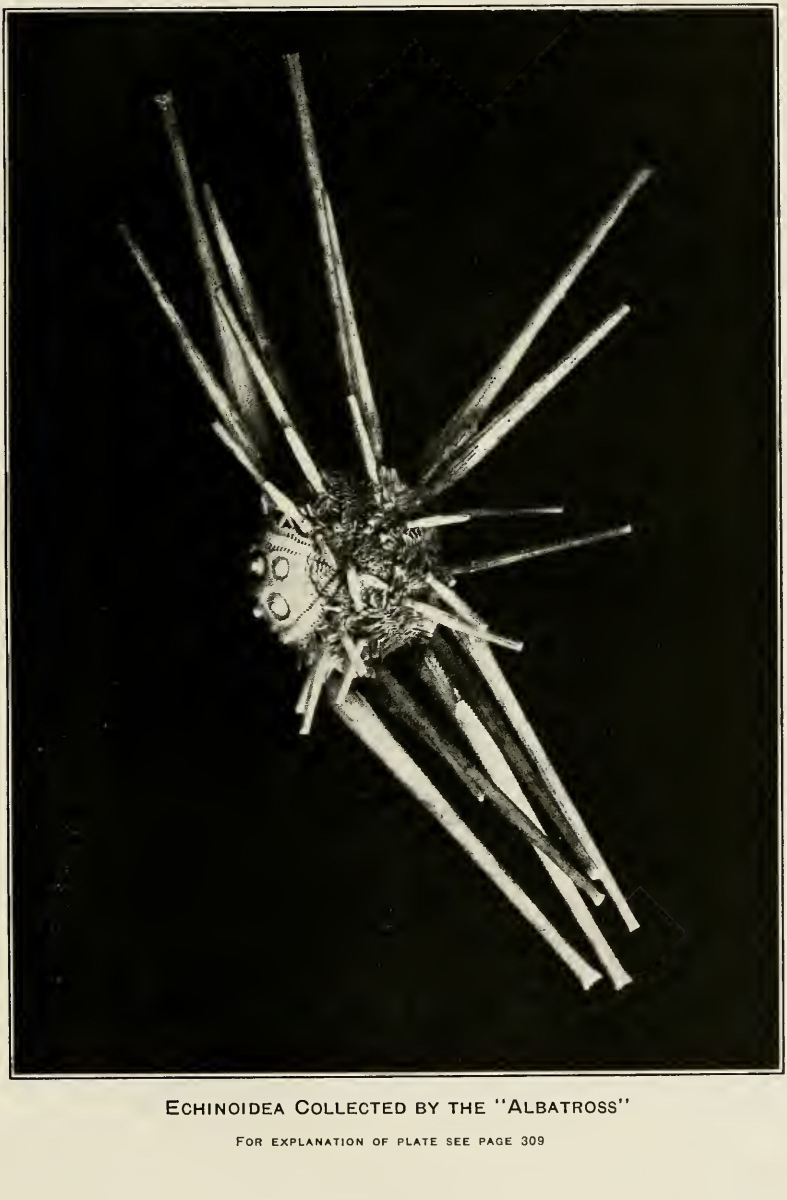
ECHINOIDEA COLLECTED BY THE "ALBATROSS"

For explanation of plate see page 309



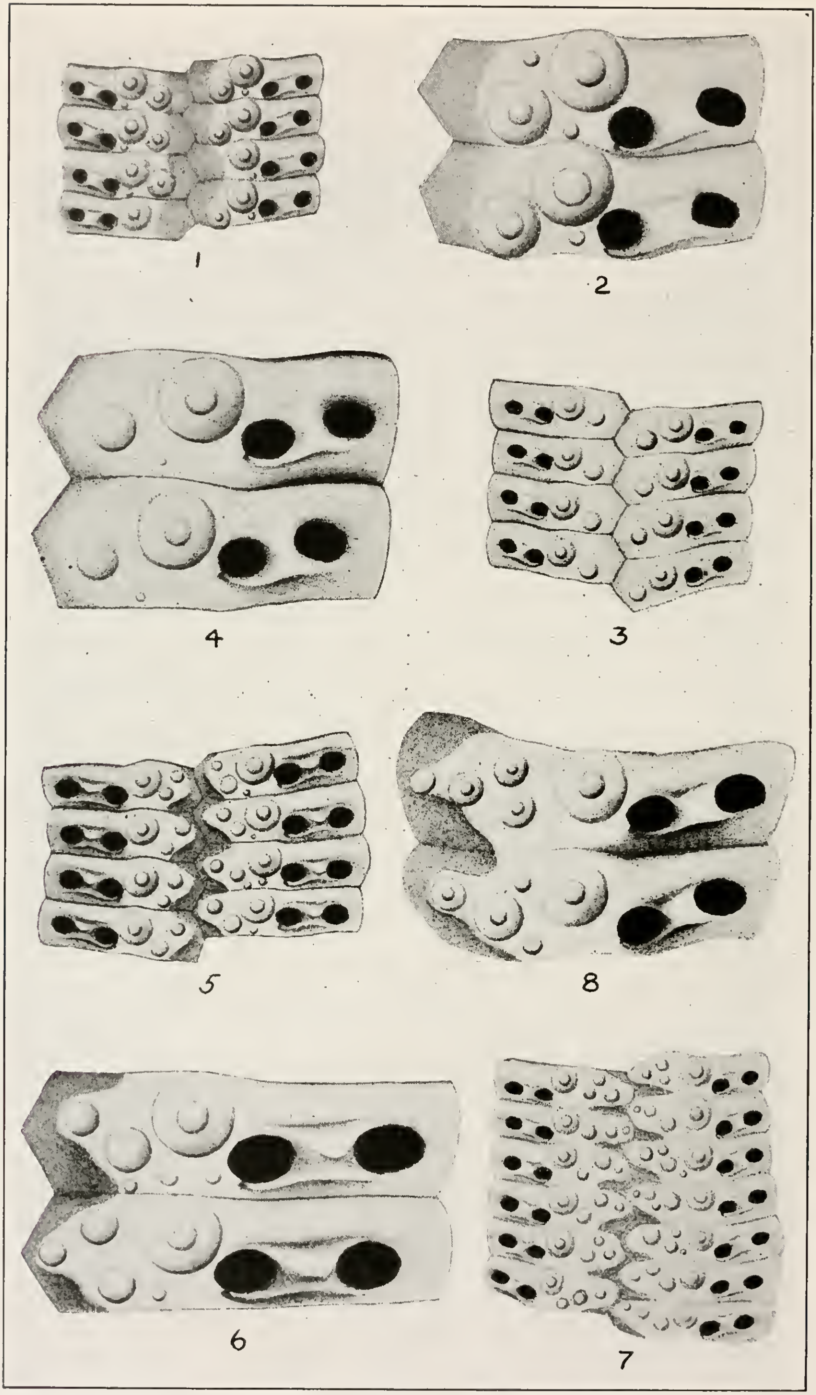
ECHINOIDEA COLLECTED BY THE "ALBATROSS"

FOR EXPLANATION OF PLATE SEE PAGE 309



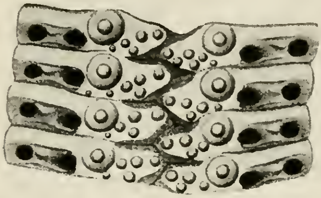
ECHINOIDEA COLLECTED BY THE "ALBATROSS"

FOR EXPLANATION OF PLATE SEE PAGE 309

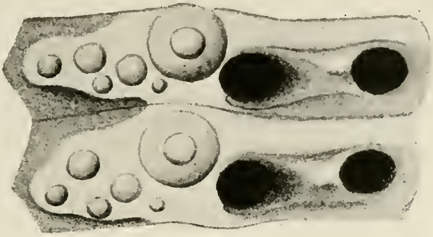


Echinoidea Collected by the "Albatross"

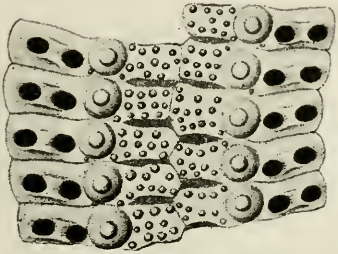
For explanation of plate see page 310



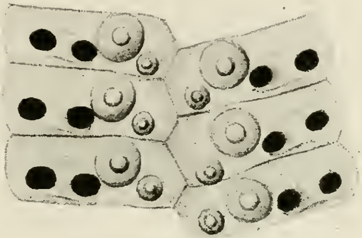
1



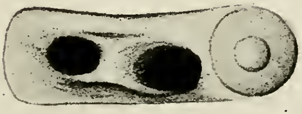
2



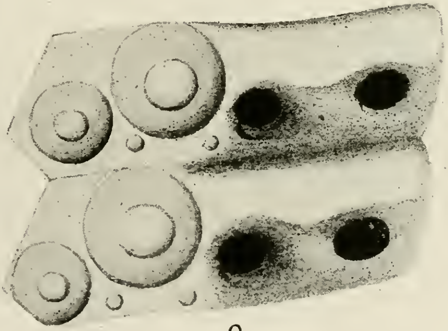
4



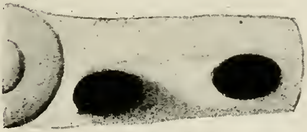
3



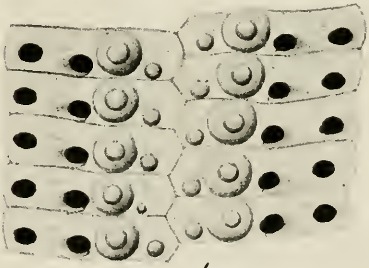
5



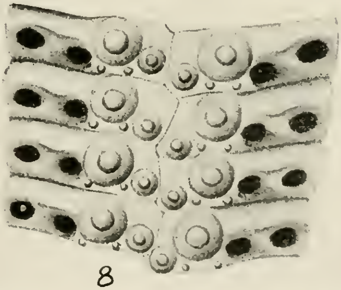
9



7



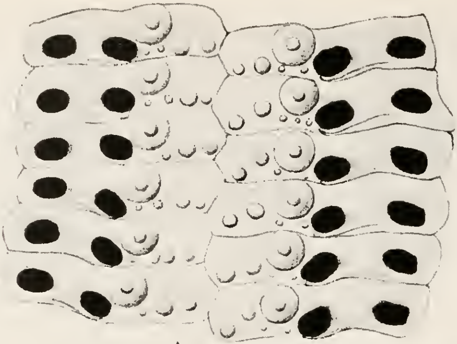
6



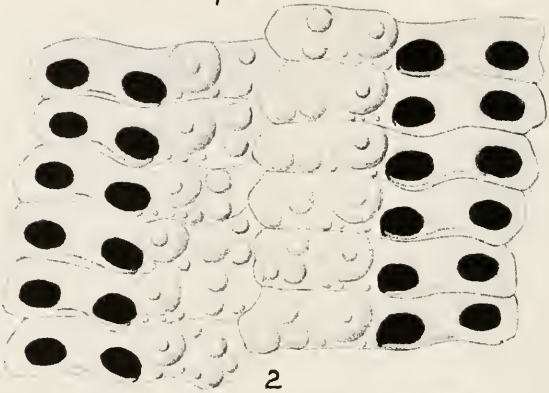
8

Echinoidea Collected by the "Albatross"

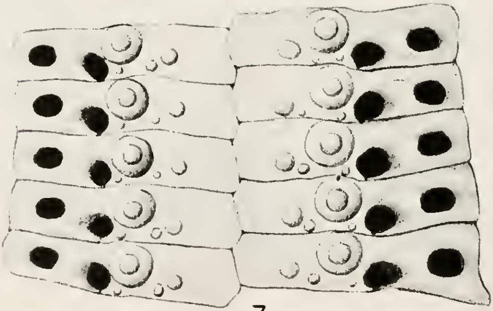
For explanation of plate see page 310



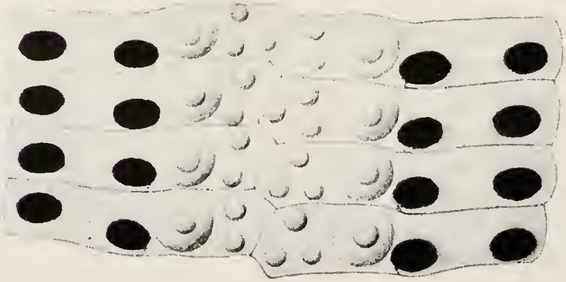
1



2



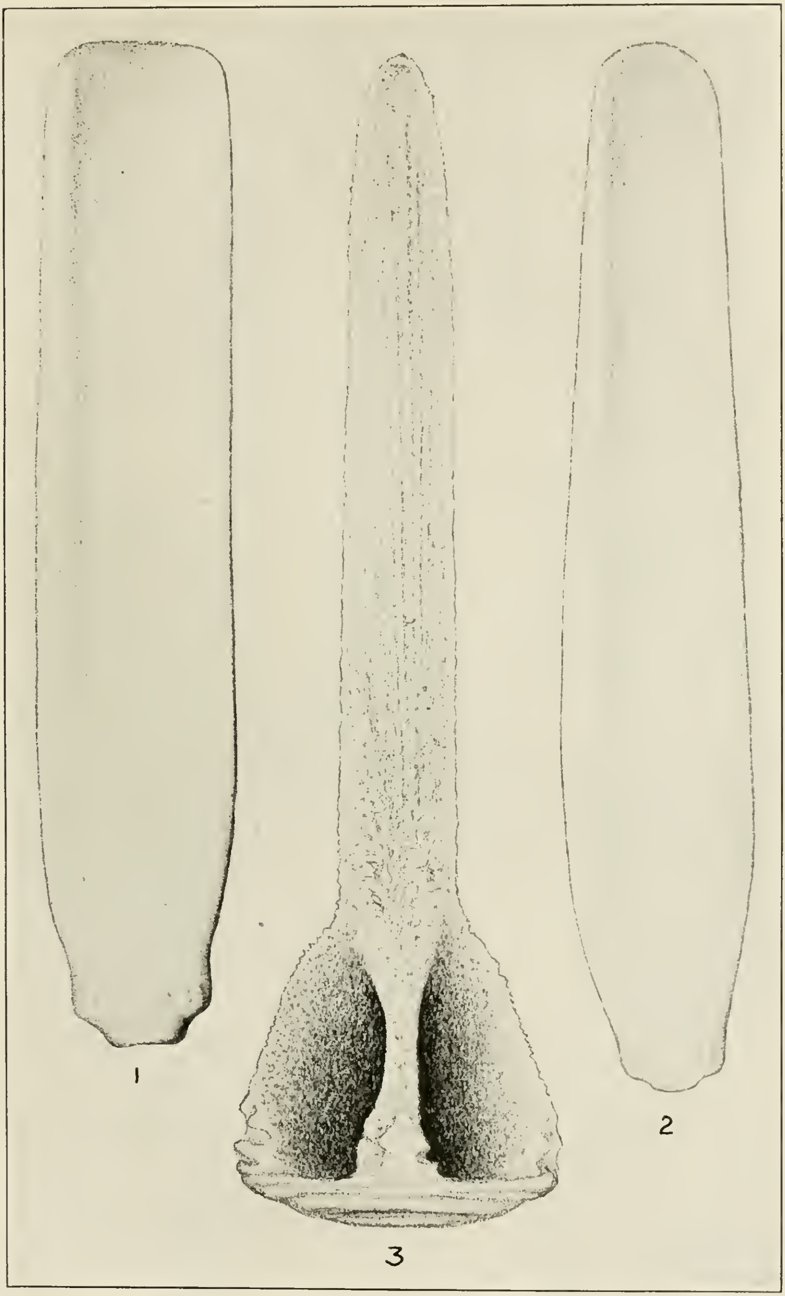
3



4

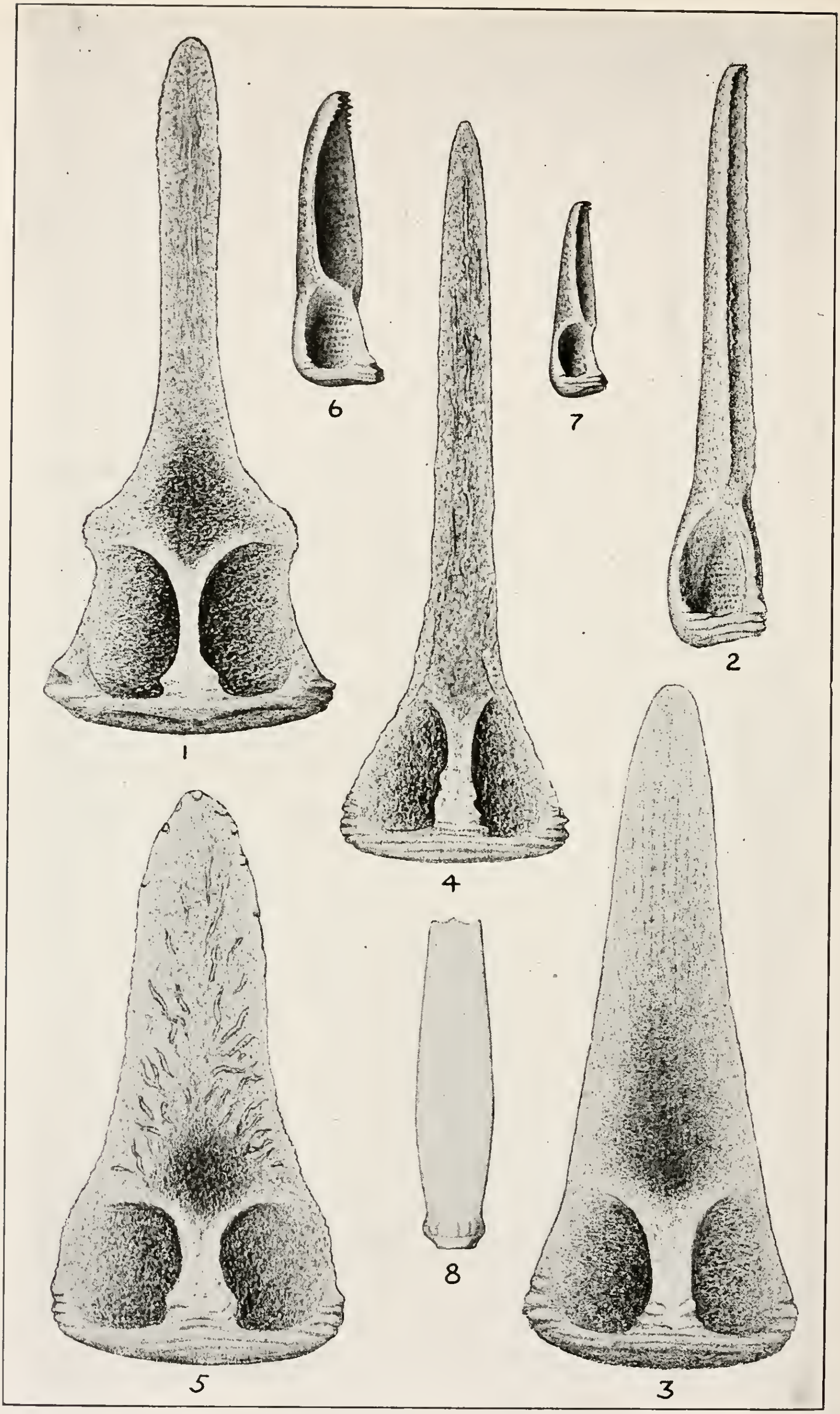
Echinoidea Collected by the "Albatross"

For explanation of plate see page 310



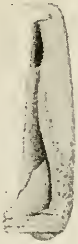
Echinoidea Collected by the "Albatross"

For explanation of plate see page 310

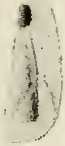


ECHINOIDEA COLLECTED BY THE "ALBATROSS"

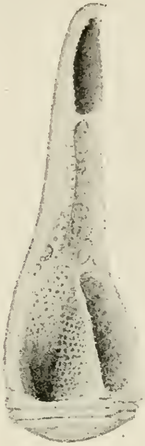
FOR EXPLANATION OF PLATE SEE PAGE 310



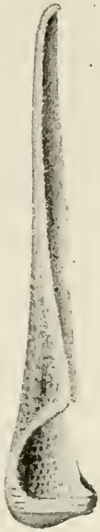
1



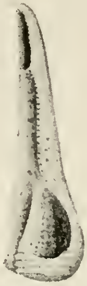
2



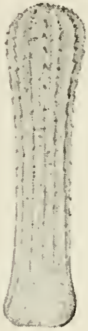
3



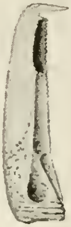
4



5



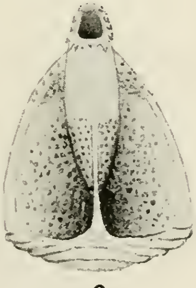
6



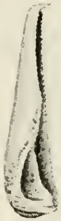
7

8.a

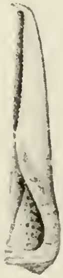
8.b



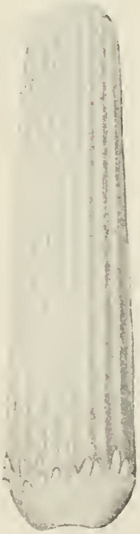
9



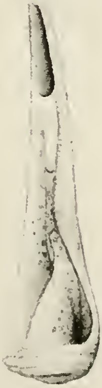
10



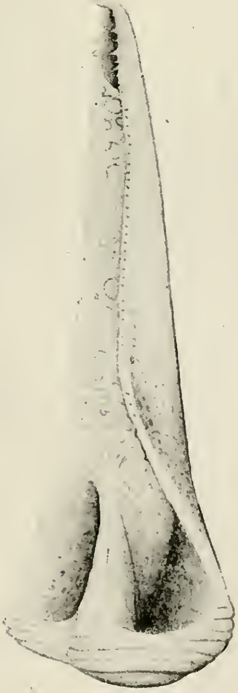
11



12



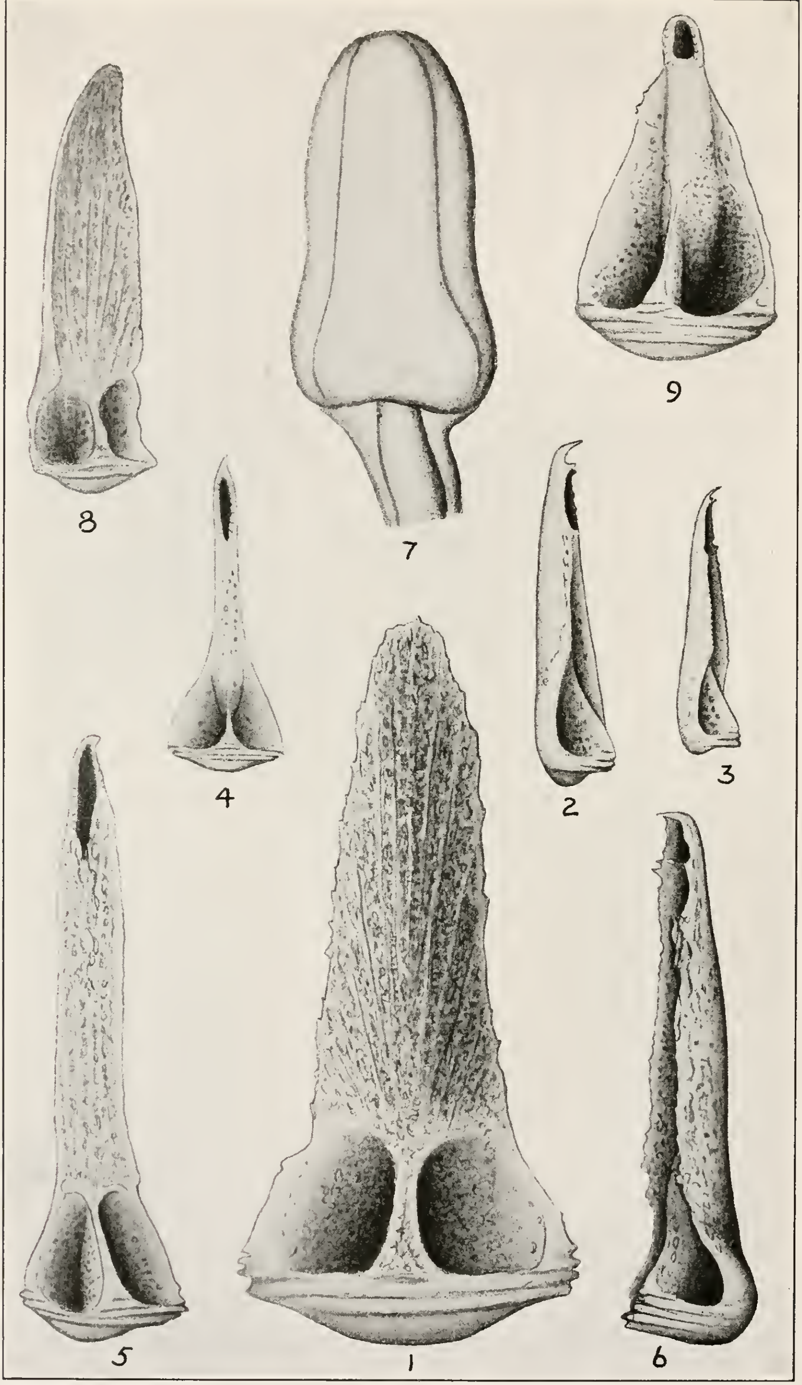
13



14

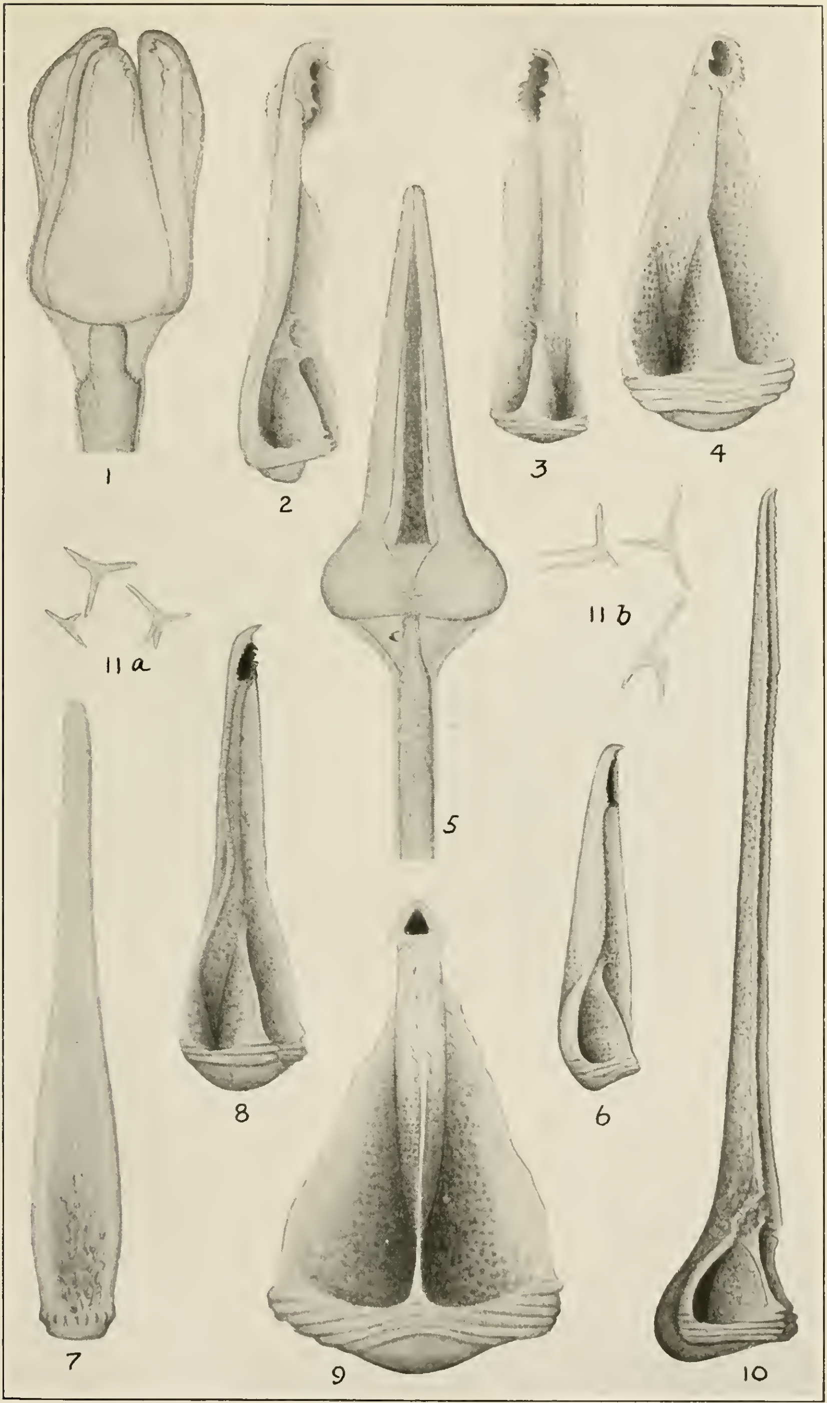
Echinoidea Collected by the "Albatross"

For explanation of plate see page 311



ECHINOIDEA COLLECTED BY THE "ALBATROSS"

FOR EXPLANATION OF PLATE SEE PAGE 311


1
2
3
4
5
11 a
11 b
8
6
7
9
10

Echinoidea Collected by the "Albatross"

For explanation of plate see page 312

FOUR NEW SPECIES OF POLYCHAETOUS ANNELIDS COLLECTED BY THE UNITED STATES FISHERIES STEAMER "ALBATROSS" DURING THE PHILIPPINE EXPEDITION OF 1907–1910

By Aaron L. Treadwell
Department of Zoology, Vassar College, Poughkeepsie, N. Y.

In the course of the further sorting of the *Albatross* Philippine collections additional marine annelids have come to light. The specimens represent four new species—*Macellicephala maculosa*, *Iphionella elongata*, *Onuphis branchiata*, and *Maldane philippinensis.* The earlier reports upon the polychaet worms of the expedition have been published in this bulletin, as follows: Treadwell, Polychaetous Annelids Collected by the United States Fisheries Steamer *Albatross* in the Waters Adjacent to the Philippine Islands in 1907–1910, volume 1, part 8; Hoagland, Polychaetous Annelids Collected by the United States Fisheries Steamer *Albatross* during the Philippine Expedition of 1907–1909, volume 1, part 9; and Treadwell, Additions to the Polychaetous Annelids Collected by the United States Fisheries Steamer *Albatross*, 1907–1910, Including One New Genus and Three New Species, volume 6, part 2.

MACELLICEPHALA MACULOSA, new species

Figure 1

The head and about 70 somites of the single specimen are preserved, these together having a length of 53 mm., with a body width of 5 mm. In preserved material the general body color is light yellow, with a pinkish tinge on the dorsal surface of the anterior 25 somites. The breadth of the prostomium is twice that of its length, and it is nearly oblong in form except for the rounded angles and the slight protrusion on the anterior margin, where the anterior tentacles are attached. (Fig. 1, *a.*) The eyes are prominent, the anterior ones being slightly the larger and located near the anterolateral angles of the prostomium. The posterior eyes are situated at a distance about equal to their own diameter posterior to the anterior ones. The tentacles are slender, sharp-pointed, about equal to the prostomium in length, two inserted on the anterior prostomial margin and the third in a shallow depression on its posterior margin. The tentacular cirri are much like the tentacles in form but are twice their length and three times their diameter. The single remaining palp is eight times as long as the prostomium and for the basal half of its length rather more than half the prostomial diameter. The terminal half narrows gradually to a moderately sharp point. Prominent dark-brown spots occur on the tentacles, tentacular cirri, and palps.

The protruded pharynx is 8 mm. long. Above and below on its terminal margin on either side of the mid line there is a row of six papillae. Dorsally the mid line is marked with a more prominent papilla. A smaller one lies in a corresponding position on the mid-ventral line. Brown spots similar to those on the head appendages occur on the papillae. In each of the upper and lower jaws are two sharp-pointed, strong, light-brown teeth.

Dorsally and ventrally the central longitudinal areas of the body are sharply differentiated from the lateral by two longitudinal muscle bands, which are more widely separated from each other ventrally than dorsally. The first pair of elytra are large enough to overlap dorsally and completely cover the head. Actually, in this preserved specimen, they are thrown forward so as to leave the head uncovered, and their anterior margins extend to the middle of the length of the palp. The second pair are smaller, and this decrease in size continues in later somites, so that in the region of the twenty-fifth they barely reach to the margin of the dorsal muscle band. They are all very thin and transparent, especially the posterior ones, which are quite invisible until lifted on the point of a needle. They are oval in outline, with smooth margins and no noticeable surface markings.

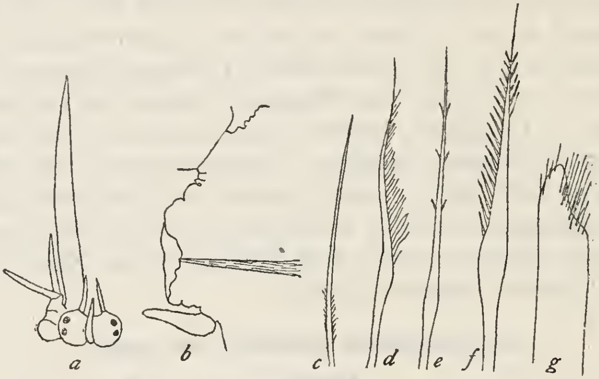


FIGURE 1.—*Macellicephala maculosa*, new species: *a*, Head, × 7½; *b*, fifteenth parapodium, × 17½; *c*, *d*, *e*, various types of dorsal setae, × 250; *f*, neuropodial seta, × 250; *g*, anterior stout seta, × 250

The anterior somites are closely crowded together, and the parapodia are nearly as long as the somites. This is doubtless due to contraction in preservation. Later somites are longer and the parapodia more prominent. A conspicuous feature of later somites is the presence of a large chitinous coiled rod, like that described in a number of other polynoids.[1] Viewed from the end, the parapodium has an oval outline, the posterior and anterior lips of the setal lobe being equal in length, the former continuous, the latter broken in the middle. The sixteenth parapodium with its elytrophore is shown in Figure 1, *b*. A heavy acicula reaches the surface near the middle of the parapodium. Dorsal to this is a tuft of very long, sharp-pointed setae carrying a fringe of fine hairs along one margin. Ventral to these are smaller ones of several kinds. (Fig. 1, *c*, *d*, *e*.) Neuropodial setae are sharp-pointed with lateral hairs along both margins. (Fig. 1, *f*.) Anterior to the above-described setae, extending above and below the acicula, is a row of much heavier ones, blunt-pointed at the apex, with terminal and subterminal bunches of stiff spines. (Fig. 1, *g*.) In more posterior somites the setal row is much shorter.

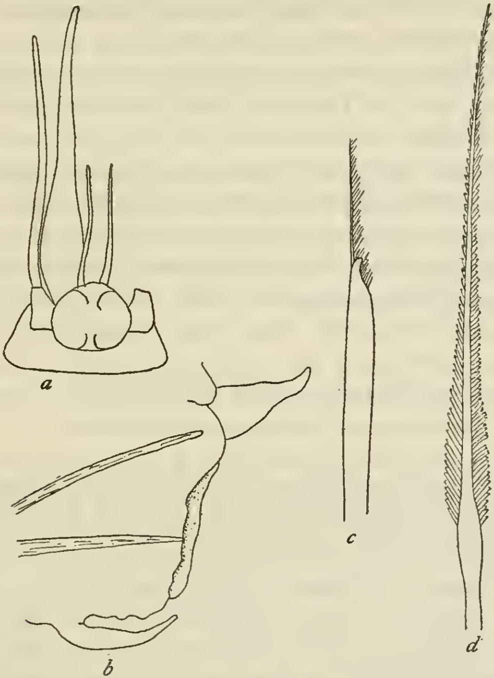


FIGURE 2.—*Iphionella elongata*, new species: *a*, Head, × 10; *b*, parapodium, × 17½; *c*, heavy seta, × 68; *d*, seta, × 185

Holotype.—U.S.N.M. No. 19543, a single imperfect specimen collected at Station D5369, off Tayabas Light, Marinduque Island (13° 48′ N., 121° 43′ E.), February 24, 1909, 106 fathoms, black sand.

IPHIONELLA ELONGATA, new species

FIGURE 2

The single specimen retains about 50 of the anterior somites. In its widest portion, 13 mm. back from the head, it is 9 mm. wide, and at the posterior end of the fragment it has narrowed to 4 mm. The prostomium is a trifle more than 1 mm. in diameter. The anterior 20 mm. of the body has a decided purple tint, and behind this region it is light brown with a darker median line. The ventral surface is divided by two parallel lines into a median narrow stripe with a broader area on either side. Where the cuticle is intact, this surface has a bluish-gray tint. When the cuticle is removed the body surface is a uniform light brown.

---

[1] Treadwell, A. L., *Acoetes magnifica*, Amer. Mus. Nov., No. 355, June 1, 1929.

The prostomial width is about twice that of its length, its two halves separated by a depressed area and, owing to the rounding of all angles, each half is nearly circular in outline. No eyes are visible, but ill-defined pigment patches occur where eyes should be. The two tentacles arise very close together on the anterior prostomial margin. (Fig. 2, *a.*) They are long, slender, and sharp-pointed, approximately three times as long as the prostomium. Only one palp is preserved, and this is narrow at the base, widening abruptly to a diameter more than twice that of its base and retaining this width for half its length and then narrowing rapidly to an acute tip. Its total length is more than three times that of the prostomium. The single remaining tentacular cirrus is very slender and almost equal to the palp in length. The cirrophores of the tentacular cirri and the dorsal surface of the prostomium are pigmented similarly to that of the dorsal surface of the first somite. The palp, tentacles, and styles of the tentacular cirri are all colorless.

Elytra are carried on somites 1, 2, 3, 6, and 8. In this specimen the anterior ones are badly rolled, and it is not possible to determine their normal form. Those farther back are ovate, with the broader end turned toward the dorsal surface of the body. They are nearly colorless, but there is a little more pigment in their dorsal than in their ventral portions. This, together with the fact that the body wall shows through the elytron, and this wall is darker dorsally than laterally, makes the distinction between the two ends of the elytron seem more marked than it really is. The margin is entire. A narrow band inside the margin has a finely granular appearance, and the whole surface inside this is divided by intersecting lines into angular areas, the whole having a strong resemblance to a cross section of a stem of a maize plant. Irregularly shaped spots of pigment are scattered along the intersecting lines.

The protruded proboscis has a row of six fleshy lobes on either side of the dorsal surface of its end. A similar lobe, but bifurcated, lies in the mid-dorsal line. There are seven or eight lobes on either side of the ventral margin. The jaws are two sharp, brown teeth, above and below.

The parapodium (fig. 2, *b*) has a fleshy setal lobe, with a heavy acicula reaching its surface at about its middle, where there is a slight surface depression. A smaller acicula extends into the base of the dorsal cirrus (or into the cirrophore of elytra bearing somites). The ventral cirrus reaches about to the end of the setal lobe, tapers gradually to the apex, and has only a very slight basal constriction. The dorsal cirrus is much larger, is flask shaped, and has a broad base.

Dorsal and ventral to the point of emergence of the large acicula is a row of a few very heavy, yellow setae. These (fig. 2, *c*) have a terminal, somewhat bent tooth, carrying on its convex surface a long slender process densely fringed along its margin. The concave surface of the terminal tooth is covered with a dense mass of slender spines. Dorsal and ventral to these setae are two tufts of setae essentially similar in the two cases. They have long, slender shafts, which slightly enlarge toward the ends and then taper to a long slender portion. (Fig. 2, *d*.) Each side of the terminal portion carries a row of radiating processes. These look like a series of sharp spines but are really thin plates with toothed terminal margins. On the scale of the drawings it is impossible to represent this detail. In the posterior parapods occur heavy, coiled, chitinous rods.

Holotype.—U.S.N.M. No. 19544, a single incomplete specimen collected February 24, 1909.[2]

ONUPHIS BRANCHIATA, new species

FIGURE 3

The *Albatross* collected three incomplete specimens of this new species of *Onuphis* at Station D5369, off Tayabas Light, Marinduque Island (13° 48′ N., 121° 43′ E.), February 24, 1909, at 106 fathoms, in black sand. The anterior ends were preserved in all cases. One fragment of about 100 somites is taken as the holotype. It is 45 mm. long and nowhere more than 2 mm. in body width. The second somite (first setigerous), the longest of any, is about one-third longer than the first, and those immediately following are progressively shorter. The first 5 somites together are as long as the 12 immediately posterior to them. Throughout the remainder of the body the somites have nearly a uniform width showing only a slight and uniform shortening posteriorly.

The cirrophores of all tentacles are long, as long as the first somite. Each is ringed for the greater part of its length, leaving a short terminal portion without rings. In the unpaired cirrophore there are six of these rings; each of the others has eight. The styles of the inner paired and the median tentacles are equal in length, all very long, as long as the first 25 somites (fig. 3, *a*), and they narrow to blunt points. The styles of the outer paired tentacles are shorter than the others in the proportion of 3:13. The frontal palps are shorter than the cirrophores of the tentacles and are not visible from the dorsal surface. The nuchal cirri are slender and extend to the apices of the tentacular cirrophores. The eyes are obscure, situated behind the bases of the outer paired tentacles.

---

[2] On this day the *Albatross* was engaged off Tayabas Light, Marinduque Island, dredging in 83 to 159 fathoms, between 8 a. m. and 3 p. m., while at 8 p. m. the dip net and electric light as a lure were used over the side. It is not indicated how this specimen was obtained. Its broken condition would seem to indicate that it had been dredged.

The gills begin as a slender filament on the first setigerous somite. In one specimen they become 2-branched on the fourth and 3-branched on the sixth. They are longest and most prominent in the regions of somites 20 to 40, where they have five slender branches and are long enough to meet over the dorsal surface of the body. In one fragment of more than 100 somites they continued to the end. Lack of complete individuals makes it impossible to tell how far they extend in the entire animal.

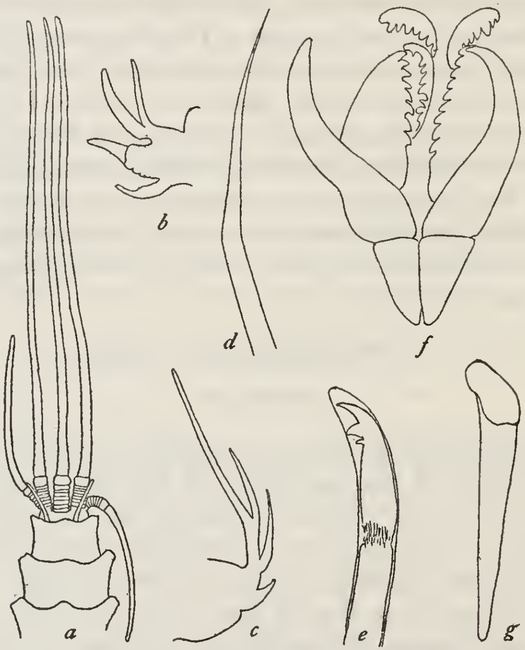


FIGURE 3.—*Onuphis branchiata*, new species: *a*, Head, × 5; *b*, first parapodium, × 10; *c*, tenth parapodium, × 10; *d*, seta from twenty-fifth parapodium, × 180; *e*, seta from first parapodium, × 180; *f*, maxilla, × 17; *g*, mandible, × 17

In the first setigerous somites the dorsal cirri are rather heavy. Farther back they are as slender as the gill branches. On the first five setigerous somites the ventral cirri are fleshy and sharp-pointed, and extend beyond the apex of the parapodium. On the seventh this cirrus becomes a prominent ventral pad extending well onto the ventral body surface. This condition continues as far as about the fifteenth setigerous somite, and behind this region the pad gradually becomes less prominent. On the sixth setigerous parapodium the condition of the ventral cirrus is intermediate between that of the fifth and the seventh.

The first parapodium (fig. 3, *b*) has a very long conical postsetal and much shorter presetal lobe, the latter having a vertical anterior margin. The setal lobe is rounded dorsally but is cut away toward the ventral end. The ventral cirrus is elongate lanceolate in form from a narrow base and reaches to just beyond the apex of the setal lobe. The dorsal cirrus is longer and slenderer than the ventral. This parapodium carries slender, needlelike setae and much heavier, hooked ones. In the tenth somite the setal lobe is small as compared with that of the first and is turned upward at an angle of 45°. The dorsal cirrus is long and slender; the ventral one has the pad form earlier mentioned. A vertical row of sharp-pointed, rather stout setae protrude slightly beyond the surface for the whole extent of the presetal lobe. Toward the upper end of this row are a few pectinate setae. The gill has two branches, one of which is long and slender. (Fig. 3, *c*.) The twenty-fifth parapodium has a conical postsetal lobe, though this is small in comparison with those of anterior somites. The presetal lobe has a vertical margin. The dorsal cirrus and bill branches are all very long, the gill branches being as long as the cirrus. Setae occur in a dense tuft. Near the upper end of the tuft are a few pectinate setae; the others are slender, some long and very slender, others bent near the ends. (Fig. 3, *d*.) Two hooked aciculae came to the surface ventral to the seta tuft. These did not appear in earlier somites. In the tenth four large setae apparently function as aciculae. Each of these has a heavy stalk that tapers abruptly at the apex to a short but very sharp-pointed terminal portion. Smaller setae having approximately the same form are associated with them. These latter protrude at the surface, their points forming a vertical row visible along the margin of the upwardly directed setal lobe. A tuft of very slender needle aciculae extends into the base of the dorsal cirrus.

In the first parapodium occur a number of the same kind of setae that McIntosh[3] figures for *O.* (*Nothria*) *willemoesii* and describes as bifid. Those in *O. branchiata* (fig. 3, *e*) have one more subterminal tooth than has *willemoesii*, and the terminal tooth is much sharper. McIntosh found them throughout the anterior region, but in the species here described they do not occur as far back as the tenth somite.

---

[3] McIntosh, W. C. Report on the Annelida Polychaeta collected by H. M. S. *Challenger* during the years 1873–1876, Rep. Sci. Res. *Challenger,* Zoology, vol. 12, p. 322, pl. 26a, fig. 1, 1885.

In the first parapodium there are also curved setae, such as those in Figure 3, *d*, and a number of straight ones, slender, sharp-pointed, and bilimbate.

The jaw apparatus is very light brown except for a transverse line at the junction of fang and carrier, the tips of the forceps, and the apices of some smaller teeth. The carriers are short (fig. 3, *f*), the width at the junction of the forceps nearly equal to their length. The right paired plate has 9 teeth, the left 8, the unpaired 9, the terminal 6 or 7. The mandibles are very slender and light brown except for a dark patch at the junction of the two halves. The beveled edges are oval, with a white incrustation. (Fig. 3, *g*.)

The animals live in thick-walled tubes composed of sand grains.

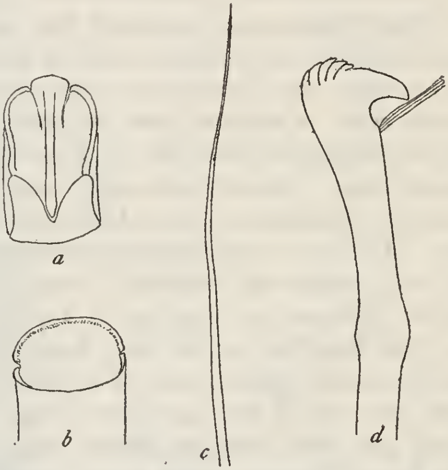


FIGURE 4.—*Maldane philippinensis*, new species: *a*, Head, × 5; *b*, pygidium, × 5; *c*, seta, × 45; *d*, hook, × 250

Holotype.—U.S.N.M. No. 19545, collected at Station D5369, off Tayabas Light, Marinduque Island (13° 48′ N., 121° 43′ E.), February 24, 1909, 106 fathoms, black sand.

MALDANE PHILIPPINENSIS, new species

FIGURE 4

At Station D5582 in the vicinity of Darvel Bay, Borneo, off Si Amil Island (4° 19′ 54″ N., 118° 58′ 38″ E.), the *Albatross* obtained fragments of a new species of *Maldane* on September 26, 1909, in 890 fathoms, in gray mud and fine sand bottom. No specimen is entire, but both anterior and posterior fragments are present, so that the essential taxonomic features can be determined. Since the fragments are in tubes in a homogeneous mass of grayish mud, it seems certain that these anterior and posterior ends really belong to the same individuals. They have been considered as representing the holotype of the species.

The prostomial disk is oval in outline and has a prominent median keel extending from the anterior to the posterior border. (Fig. 4, *a*.) The margin is elevated to form a distinct rim, which is cut by two pairs of incisions. Those of the anterior pair extend one on either side from near the anterior end of the central keel to the margin, cutting off an upper lip the margin of which extends about one-quarter of a circle. The other pair of incisions cut only the marginal rim and lie on either side about one-third of the distance forward from the posterior border. The mouth lies immediately under the rounded anterior lip. The pygidium is broadly oval and has a thin, elevated margin all the way around, this margin incised on either side just dorsal to the lateral median line. (Fig. 4, *b*.) The anus is dorsal.

The dorsal setae are long, slender, and very sharp-pointed. Eight or ten of these occur in each tuft, and they vary in size. (Fig. 4, *c*.) The hooks lie in a single row. Each (fig. 4, *d*) is heavy and has a large terminal hook and a series of poorly defined apical denticulations. At the point where the hook pierces the cuticle the shaft is swollen, and from this point it tapers to the inner end, the embedded portion of the hook being about eight times the length of the exposed.

Holotype.—U.S.N.M. No. 19546.

○

THE PHILIPPINE LAND MOLLUSKS OF THE GENUS OPISTHOPORUS

By Paul Bartsch

Curator, Division of Mollusks and Cenozoic Invertebrates, United States National Museum

In the Cyclophoridae, as in the Annulariidae, we find in some groups wonderful provision for breathing, even when the mollusk has tightly closed its shell with its operculum. One of these devices is characteristic of the genus treated in this paper—*Opisthoporus*. This genus is closely allied to the widely distributed and profusely specifically differentiated genus *Eucyclotus*, which it resembles in general form, in color pattern, and in the structure of the operculum. It is, however, at once distinguished from *Eucyclotus* by the presence of a breathing tube, a slender curved hollow horn open at its tip and at the shell end, which furnishes a breathing pore when the mollusk withdraws into its shell and closes its door with its operculum against undesirable visitors or enemies.

The type of the genus, *Opisthoporus biciliatus* Mousson, was described from the Botanic Garden at Buitenzorg, Java, whither it was transported with plants from Borneo. The genus seems centralized in Borneo. It extends north into the Philippines as indicated in the present paper and south into Celebes, Singapore, Sumatra, and Java.

The character of the breathing tube is shown in the illustrations of the various Philippine races on Plate 81 and the operculum in Figure 1. The relief map (pl. 82) figures the distribution of *Opisthoporus* in the Philippine Islands.

OPISTHOPORUS QUADRASI PALAWANENSIS, new subspecies

Plate 81, Figure 5

1889. *Opisthoporus quadrasi* Dohrn, Nachrichtsbl. Deutschen Malak. Ges., p. 55, in part.

1897. *Opisthoporus quadrasi* Kobelt and Möllendorff, Nachrichtsbl. Deutschen Malak. Ges., vol. 29, p. 119, in part.

1898. *Opisthoporus quadrasi* Möllendorff, Abh. Naturf. Ges. Görlitz, vol. 22, p. 185, in part.

Shell large, thin, semitranslucent, very depressed helicoid. The first two whorls pale chocolate-brown, the rest yellowish horn colored, marked by numerous axial brown fulgurations, which are about as wide as the spaces that separate them; they extend to the peristome on the last whorl. The upper side of all the whorls is strongly rounded, and marked by rather strong incremental threads and closely spaced microscopic spiral striations where protected by the sutures. The whorls show numerous slender fine lines, which here are stronger than those in typical *Opisthoporus quadrasi* from Balabac. The siphon is about 4 mm behind the peristome and is directed forward in a curve. Periphery well rounded. Base openly umbilicated, showing all the whorls within. These whorls are strongly rounded and marked here as on the upper surface, but the sculpture is slightly finer. Aperture and operculum as in *Opisthoporus quadrasi quadrasi*.

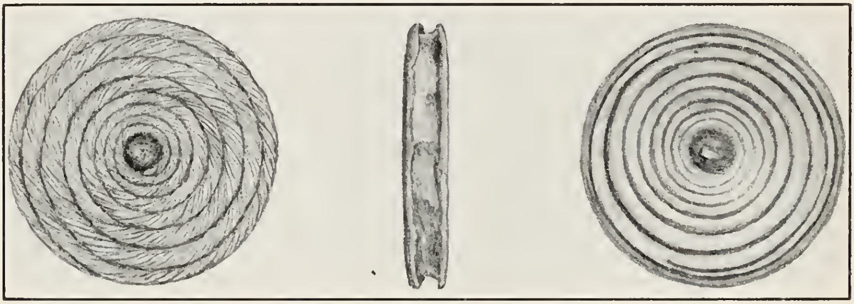


FIGURE 1.—Operculum of *Opisthoporus*

Type.—U.S.N.M. No. 313010, from Iwahig, Palawan. It has 4.5 whorls, and measures: Height, 7.5 mm; greater diameter, 16.2 mm; lesser diameter, 11.7 mm.

Additional material.—Additional specimens examined yield the data given in the table below.

U. S. N. M. No.	Number of whorls	Height	Greater diameter	Lesser diameter	Locality
		Mm	*Mm*	*Mm*	
313011	4. 5	7. 8	17. 4	12. 9	Iwahig.
313012	4. 3	7. 8	16. 8	12. 9	Ulugan.
127157	4. 5	7. 7	17. 2	12. 6	Palawan.
127157	4. 5	7. 4	16. 4	12. 5	Do.

Remarks.—This subspecies differs from typical *Opisthoporus quadrasi quadrasi* in being larger and in having dark early whorls and stronger sculpture.

OPISTHOPORUS QUADRASI QUADRASI Crosse

PLATE 81, FIGURE 4

1888. *Opisthoporus quadrasi* (CROSSE) HIDALGO, Journ. Conch., vol. 36, pp. 59, 60, pl. 5, figs. 6, 6a, 6b.

1889. *Opisthoporus quadrasi* DOHRN, Nachrichtsbl. Deutschen Malak. Ges., p. 55, in part.

1896. *Opisthoporus quadrasi* ELERA, Catalogo sistematico fauna Filipinas, vol. 3, p. 689, in part.

1897. *Opisthoporus quadrasi* KOBELT and MÖLLENDORFF, Nachrichtsbl. Deutschen Malak. Ges., vol. 29, p. 119, in part.

1898. *Opisthoporus quadrasi* MÖLLENDORFF, Abh. Naturf. Ges. Görlitz, vol. 22, p. 185, in part.

Shell small, moderately thick, depressed helicoid, yellowish horn colored. All but the first one and one-half whorls are marked with numerous fulgurations of brown on the upper side, which are a little wider than the light areas separating them. These fulgurations extend almost to the peristome. The upper surface, except the smooth nuclear portion, is marked by closely spaced incremental threads and almost obsolete incised spiral lines. The siphon is about 4 mm behind the peristome. It points forward and is marked by rather coarse annulations. Periphery well rounded. Base with an open funnel-shaped umbilicus, showing all the whorls within, with the sculpture a little finer than that of the upper surface. Operculum with eight spiral lamellae, which are marked by oblique raised threads. The depressed center of the operculum is smooth.

The specimen described and figured (U.S.N.M. No. 303075) comes from the type locality, Balabac Island. It has 4.4 whorls, and measures: Height, 7.8 mm; greater diameter, 14.7 mm; lesser diameter, 11.3 mm.

Remarks.—The Balabac species resembles *Opisthoporus quadrasi turturinganus* most nearly in size, but it differs in being more elevated, in having the whorls more inflated, in being less openly umbilicated, and in being fulgurated on the upper surface. The sculpture, too, is finer.

OPISTHOPORUS QUADRASI BUSUANGENSIS, new subspecies

PLATE 81, FIGURE 3

1896. *Opisthoporus quadrasi* ELERA, Catalogo sistematico fauna Filipinas, vol. 3, p. 689, in part.

1897. *Opisthoporus quadrasi* KOBELT and MÖLLENDORFF, Nachrichtsbl. Deutschen Malak. Ges., vol. 29, p. 119, in part.

1898. *Opisthoporus quadrasi* MÖLLENDORFF, Abh. Naturf. Ges. Görlitz, vol. 22, p. 185, in part.

Shell moderately large, thin, depressed helicoid. The first one-half turn light horn colored, the succeeding two dark chestnut-brown, the rest pale yellowish horn colored with axial fulgurations of brown. The fulgurations terminate about one-fifth of a turn behind the peristome, but this area shows irregularly distributed axial bands of brown of varying width. The nuclear whorls are smooth, the rest marked by slender threadlike incremental lines and exceedingly fine, almost obsolete spiral threads. The siphon is about 0.4 mm behind the peristome. It is curved forward and marked by numerous slender annulations. Periphery well rounded. Base open, forming a funnel-shaped umbilicus, showing all the turns within sculptured like the upper surface, but less strongly. The fine hairlike sculpture remaining in the suture of the umbilicus is short and very slender. The aperture is typical. There are 10 lamellae on the operculum.

Type.—U.S.N.M. No. 303076, collected by Quadras at Busuanga. It has 4.4 whorls, and measures: Height, 8 mm; greater diameter, 16.1 mm; lesser diameter, 12 mm.

Remarks.—This race is very close to *Opisthoporus quadrasi palawanensis*, but can be readily distinguished from it by the fulgurations, which do not extend to the peristome.

OPISTHOPORUS QUADRASI TURTURINGANUS, new subspecies

Plate 81, Figure 2

Shell small, thin, very depressed helicoid. All but the last turn and a quarter chocolate-brown, the last part yellowish horn colored. The first turn is well rounded, smooth, and glassy. The succeeding whorls are also well rounded and are marked by closely spaced incremental lines, which are raised into slender lines. On the upper surface fine, closely spaced, incised spiral lines cut the axial thread and lend the surface a silky luster. The siphon is situated about 4 mm behind the peristome at the suture, the tube being bent obliquely forward or forward and downward. It is marked by numerous incremental threads. Periphery well rounded. Base with open funnel-shaped umbilicus, showing all the whorls within marked like the upper surface of the shell but a little less strongly so. Here and there on the whorls within the umbilicus exceedingly fine short hairs are present. Aperture circular; peristome double; the inner lightly exserted and very slightly reflected, the outer thin, translucent, slightly expanded on the columellar edge, a little more so on the basal and outer lip and forming a moderately strong auricle at the posterior angle of the aperture. Operculum with a smooth flat inner plate, concave edge, and slightly concave outer surface. The outer surface shows at least 10 closely coiled whorls with an inner smooth nuclear portion. These whorls are marked by numerous obliquely placed threads, which are of varying strength.

Type.—U.S.N.M. No. 313013, from Turturingan, Palawan. It has 4.3 whorls, and measures: Height, 7 mm; greater diameter, 15.1 mm; lesser diameter, 11 mm. The operculum measures: Thickness, 0.6 mm; diameter, 4.7 mm. A topotype, U.S.N.M. No. 313014, has 4.3 whorls, and measures: Height, 6.4 mm: greater diameter, 13.9 mm; lesser diameter, 10.6 mm.

Remarks.—This species is nearest in size to typical *Opisthoporus quadrasi quadrasi*, but differs from this by the absence of fulgurations and in having much stronger axial and spiral sculpture.

OPISTHOPORUS QUADRASI, subspecies ?

Plate 81, Figure 1

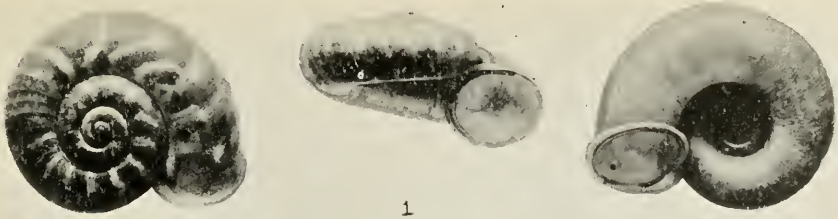
U.S.N.M. No. 130872 contains three specimens said to have been collected by Osborn on the island of Panay. These seem so far out of the regular range of distribution that I refrain from commenting upon them further than to say that they resemble quite closely the shells here described as *Opisthoporus quadrasi palawanensis*. It is possible that specimens may have been transferred with cultural plants, as in the case of *Opisthoporus biciliatus* Mousson.

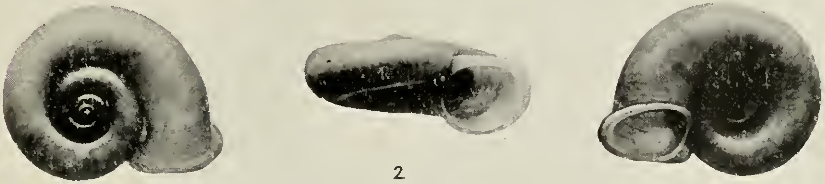
OPISTHOPORUS QUADRASI, subspecies ?

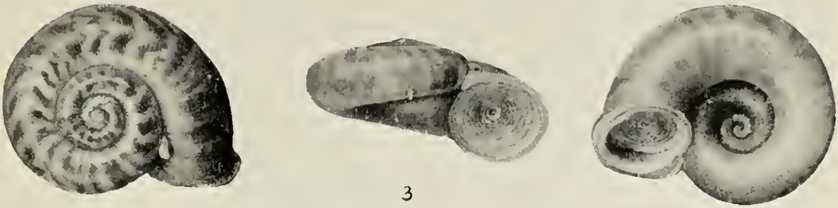
Plate 81, Figure 6

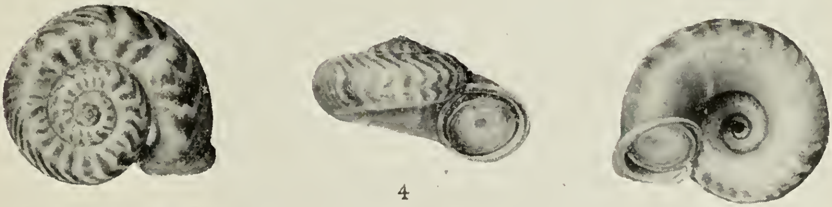
U.S.N.M. No. 201071a contains the specimen that I have here figured from Palo Leyte. It was donated to the National Museum by Walter F. Webb.

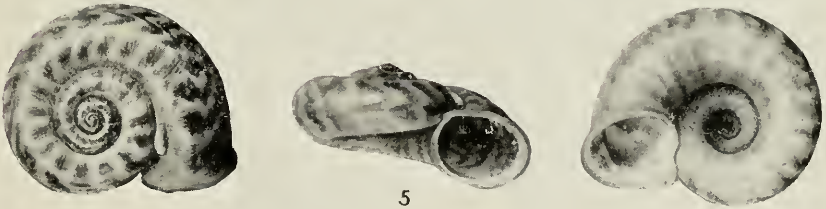
The remarks under the last apply here as well.

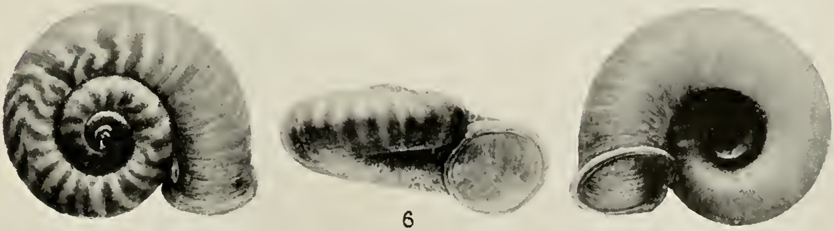

1


2


3

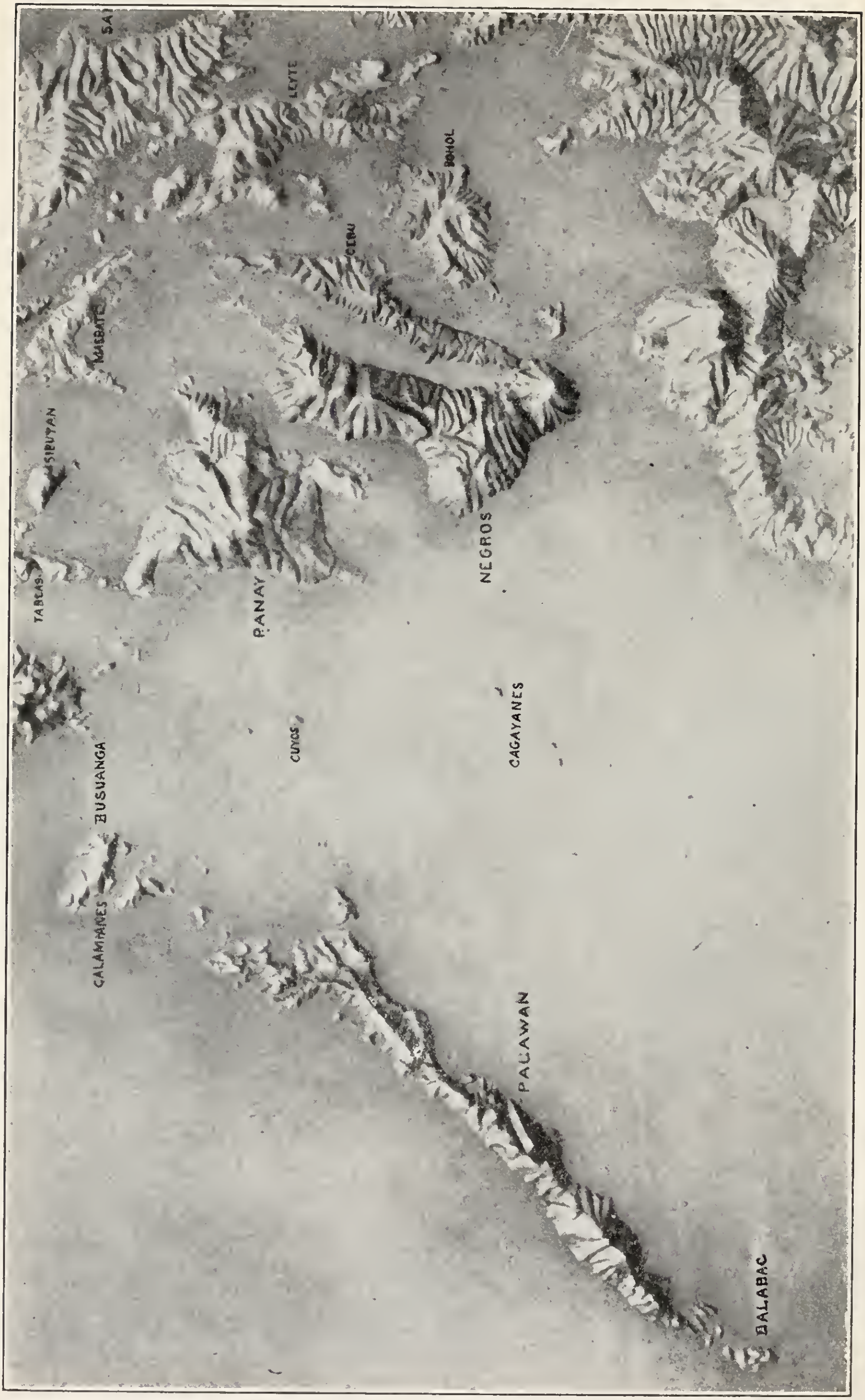

4


5


6

THE PHILIPPINE SPECIES OF OPISTHOPORUS

1, *Opisthoporus quadrasi*, subspecies ?; 2, *O. q. turturinganus*, new subspecies; 3, *O. q. busuangensis*, new subspecies; 4, *O. q. quadrasi* Crosse; 5, *O. q. palawanensis*, new subspecies; 6, *O. quadrasi*, subspecies ?.


SA
LEYTE
BOHOL
CEBU
MASBATE
SIBUYAN
NEGROS
TABLAS
PANAY
CUYOS
CAGAYANES
BUSUANGA
CALAMIANES
PALAWAN
BALABAC

Relief Map Showing the Distribution of Opisthoporus in the Philippines

THE PHILIPPINE LAND MOLLUSKS COCHLOSTYLA RUFOGASTER AND OBBA MARMORATA AND THEIR RACES

By Paul Bartsch

Curator, Division of Mollusks and Cenozoic Invertebrates, United States National Museum

COCHLOSTYLA RUFOGASTER AND ITS RACES

A sending of a lot of specimens of what is herein described as *Cochlostyla rufogaster juani*, by the Philippine Bureau of Science for determination, has made it necessary to subject the entire complex of *Cochlostyla rufogaster*, as well as some other species which have sometimes been designated under this name, to a critical review, the results of which are set forth in the following pages.

All the specimens mentioned as having been collected by me were obtained during the cruise of the United States Bureau of Fisheries steamer *Albatross* in the Philippine Archipelago, 1907 and 1908.

Lesson, in 1831, described, and figured on Plate 22 of his Illustrations de Zoologie, a shell in the collection of the Duke of Rivoli. The figure, I believe, is referable to the large conic race that inhabits the region about Mariveles, Bataán Province, Luzon. The shell figured is a dead decorticated specimen, the loss of whose epidermis exposed the red color of the later turns and the light peripheral zone. Lesson states that the habitat from which the specimen came was unknown.

Cochlostyla rufogaster as now conceived extends over central Luzon from Benguet south to Mount Banahao and Mount Maquiling. As is usual with Philippine land shells, we find that a certain degree of differentiation has taken place in the shells in the various habitats occupied, which makes it not only possible but desirable to recognize certain zoogeographic races and to designate these as subspecies, which is here done.

The races of *Cochlostyla rufogaster* vary from elongate-conic to ovate, from moderately slender to inflated. They range in height from more than 90 mm to less than 50 mm. In shells with perfect periostracum this is buff on the early whorls and wood brown on the later, marked by retractively slanting zones of dark brown. These dark zones form a more or less fenestrated pattern occupying the region immediately below the suture. This character finds varying degrees of expression in the different subspecies. There is usually a light peripheral zone, which shows considerable variation in width in different shells and in some specimens appears almost completely if not quite suppressed. The periostracum is also marked by fine axial hair lines of varying shades of brown and numerous equally slender spiral lines on spire and base. Decorticated specimens show the early whorls flesh colored, the succeeding turn or two of buffish tinge, followed by reddish-orange to chestnut-brown tints. The peristome is dark; the columella white tinged with brown, while the parietal callus usually agrees with the interior of the aperture in color, varying from bluish white to pale slate-blue.

COCHLOSTYLA RUFOGASTER BENGUETANA, new subspecies

PLATE 83, FIGURE 2

1891. *Cochlostyla rufogaster* HIDALGO, Obras Malacologicas, p. 373, in part.
1898. *Cochlostyla rufogastra* MÖLLENDORFF, Abh. Naturf. Ges. Görlitz, vol. 22, p. 138, in part.
1912. *Cochlostyla rufogaster* MÖLLENDORFF, Kobelt and Winter, Semper's Reisen im Archipel der Philippinen, vol. 10, pt. 14, p. 287, in part.

This northern mountain race is elongate-ovate, with the whorls rather inflated and rather strongly rounded at the summit. The periphery of the last whorl is well rounded, showing no trace of angulation. The unique type lacks the light peripheral zone. The interior is bluish pearl gray and the peristome pale chocolate-brown. In the inflation and rounding of the summit of the whorls it resembles *Cochlostyla rufogaster montalbana*, from which it is readily distinguished by its much narrower shape and lack of peripheral angulation.

Type.—U.S.N.M. No. 208212, from Trinidad, Benguet Province, Luzon. It has 6.1 whorls, and measures: Height, 76.2 mm; greater diameter, 50.7 mm.

Remarks.—The references cited above refer to members of this species in the general region from which the type came, and I believe belong to this subspecies.

COCHLOSTYLA RUFOGASTER JUANI, new subspecies

PLATE 85, FIGURE 1

Shell rather broadly ovate with the whorls somewhat inflated and rather well rounded, particularly so near the summit. The peripheral light zone is not overly strongly emphasized in the 15 shells before us. In seven of them there is not a trace of it, and none shows it when decorticated. The last whorl is very dark chestnut-brown, while the peristome and the major portion of the columella are almost black. The inside of the aperture is equally dark, bluish pearl gray—darker than those in any other race before us.

This race seems nearest to *Cochlostyla rufogaster rufogaster*, from which it is easily distinguished by its much darker coloration and the lack of the conspicuous peripheral band in the decorticated shell. The peripheral angle is also almost absent.

Type.—U.S.N.M. No. 313002, as well as all the specimens before us, was collected at Novaliches, northeast Rizal Province, Luzon. It has 5.9 whorls, and measures: Height, 64.3 mm; greater diameter, 48.1 mm.

Remarks.—The rest of these specimens yield the following data:

Number of whorls	Height	Greater diameter	Number of whorls	Height	Greater diameter
	Mm	*Mm*		*Mm*	*Mm*
6.4	65. 7	45. 6	6.0	62. 2	43. 8
6.2	63. 4	48. 0	6.0	56. 9	43. 9
6.1	61. 5	43. 0	6.1	61. 3	44. 3
6.2	62. 8	45. 0	6.0	68. 7	53. 2
6.3	65. 4	43. 0	6.1	61. 5	41. 8
6.2	65. 4	44. 3	6.2	56. 2	42. 3
6.0	62. 0	45. 8	5.9	49. 6	36. 7

The last specimen was severely injured at an early stage and is decidedly dwarfed and abnormal.

Nine of these specimens were collected by F. Juan, for whom I have named the race; the rest were secured by A. Duyag.

COCHLOSTYLA RUFOGASTER MONTALBANA, new subspecies

PLATE 83, FIGURE 1

1846. *Bulimus rufogæster* PFEIFFER, Martini-Chemnitz Conchylien Cabinet, 2d ed., vol. 1, Abth. 12, Theil 2, pp. 164–165, in part, pl. 50, fig. 21.
1850. *Bulimus rufogaster* REEVE, Conchologia Iconica, species 4, in part.
1851. *Bulimus rufogaster* DESHAYES, Fęrussac's Histoire naturelle mollusques, vol. 1, p. 9, in part, pl. 116, figs. 3, 6.
1890. *Cochlostyla rufogaster* PILSBRY, Man. Conch., ser. 2, vol. 6, p. 207, in part, pl. 43, fig. 26.
1891. *Cochlostyla rufogaster* HIDALGO, Obras Malacologicas, p. 373, in part, pl. 61, fig. 5?; pl. 105, fig. 5.

This race is rather large and broadly ovate. It has an obsolete peripheral angle, and a light zone may or may not be present at this place under the periostracum. It suggests most nearly *Cochlostyla* *rufogaster manilana*, but differs from it in being broader and in having the whorls more inflated.

Specimens examined.—The type, U.S.N.M. No. 255859, was collected by me at Montalban, Rizal Province, Luzon. It has 6.1 whorls, and measures: Height, 75.2 mm; greater diameter, 52.3 mm. Another specimen, U.S.N.M. No. 256084, also collected by me at the type locality, has 6.1 whorls, and measures: Height, 69.3 mm; greater diameter, 53 mm. Two specimens from the type locality collected by LeRoy Topping also have each 6.1 whorls, and measure: Height, 71.8 and 70.8 mm; greater diameter, 53.2 and 52.8 mm, respectively. In addition to this there are a number of shells present that are not quite mature.

COCHLOSTYLA RUFOGASTER ANTIPOLANA, new subspecies

PLATE 85, FIGURE 2

1891. *Cochlostyla rufogaster* HIDALGO, Obras Malacologicas, pp. 372–374, in part.

Shell small, broadly ovate, obscurely angulated at the periphery. Peripheral light band narrow, bordered posteriorly by a dark zone. The light zone is scarcely indicated in decorticated specimens. Interior bluish pearly; peristome chocolate-brown; pillar axially mottled with brown.

Specimens examined.—The type, U.S.N.M. No. 240246, was collected by LeRoy Topping at Antipolo, Rizal Province, Luzon. It has 6.1 whorls, and measures: Height, 58.7 mm; greater diameter, 48.3 mm. U.S.N.M. No. 255985 contains two specimens collected by myself near the falls at Antipolo. These measure:

Number of whorls	Height	Greater diameter
	Mm	*Mm*
6.1	56. 2	39. 2
5.6	51. 5	41. 6

In its small size this race approaches *Cochlostyla rufogaster monozona* Pfeiffer. It is, however, more broadly ovate and has the periphery much more strongly angulated.

COCHLOSTYLA RUFOGASTER MONOZONA (Pfeiffer)

PLATE 84, FIGURES 1, 2

1846. *Bulimus monozonus* PFEIFFER, Monographia heliceorum viventium, vol. 2, p. 533.

1848. *Bulimus monozonus* PFEIFFER, Proc. Zool. Soc. London, p. 110.

1850. *Bulimus monozonus* PFEIFFER, Martini-Chemnitz Conchylien Cabinet, 2d ed., vol. 1, Abth. 12, Theil 2, 159, t. 46, figs. 7, 8.

1851. *Bulimus monozonus* REEVE, Conchologia Iconica, pl. 32, fig. 195.

1853. *Bulimus monozonus* PFEIFFER, Monographia heliceorum viventium, vol. 3, p. 296.

1858. *Bulimus monozonus* H. and A. ADAMS, Genera of recent Mollusca, vol. 2, p. 142.

1860. *Orthostylus monozona* MARTENS, Albers, Die Heliceen, 2d ed., p. 178.

1868. *Bulimus monozonus* PFEIFFER, Monographia heliceorum viventium, vol. 6, p. 6.

1868. *Cochlostyla monozonus* PFEIFFER, Monographia heliceorum viventium, vol. 6, p. 6.

1872. *Orthostyla monozonus* V. MARTENS, Malacozool. Blät., vol. 20, p. 178.

1874. *Cochlostyla monozona* SEMPER, Reisen im Archipel der Philippinen, pt. 2, vol. 3, p. 205. in part.

1876. *Bulimus monozonus* PFEIFFER, Monographia heliceorum viventium, vol. 8, in part, p. 7.

1876. *Cochlostyla monozona* PFEIFFER, Monographia heliceorum viventium, vol. 8, in part, p. 7.

1887. *Cochlostyla rufogaster* HIDALGO, Journ. Conchyl., vol. 35, pp. 160–1, in part.

1890. *Cochlostyla rufogaster* PILSBRY, Man. Conch., ser. 2, vol. 6, pp. 207–8, in part, pl. 45, fig. 47.

1891. *Cochlostyla rufogaster* HIDALGO, Obras Malacologicas, pp. 372–4.

1894. *Helicostyla rufogastra monozonus* PILSBRY, Man. Conch., ser. 2, vol. 9, p. 227.

1896. *Helicostyla rufogastra monozonus* ELERA, Catalogo sistematico de toda la fauna Filipinas, vol. 3, p. 593, in part.

1898. *Cochlostyla rufogastra* MÖLLENDORFF, Abh. Naturf. Ges. Görlitz, vol. 22, p. 138, in part.

1912. *Cochlostyla rufogastra* MÖLLENDORFF, Kobelt and Winter, Semper's Reisen im Archipel der Philippinen, vol. 10, pt. 14, p. 287.

This is the small race said to come from Manila. Our specimens show the pale yellow, rather broad peripheral zone when the periostracum is removed. The shell is much more oval than in *Cochlostyla rufogaster antipolana*, and the periphery of the last whorl has the merest indication of an angulation.

Specimens examined.—The specimen described and figured is one of two, U.S.N.M. No. 66178, collected by J. B. Steere at Manila. It has six whorls, and measures: Height, 49.2 mm; greater diameter, 35.3 mm. The other shell also has six whorls, and measures: Height, 48.2 mm; greater diameter, 37.7 mm. Two additional specimens collected by Febiger, U.S.N.M. No. 105247, also come from Manila. One of these is not quite adult. The adult shell has 5.9 whorls, and measures: Height, 47 mm; greater diameter, 34.2 mm.

U.S.N.M. No. 315681 contains a specimen from the Evezard collection, which belongs here. This has 5.7 whorls, and measures: Height, 52 mm; greater diameter, 39.3 mm.

COCHLOSTYLA RUFOGASTER MANILANA, new subspecies

PLATE 84, FIGURE 4

1867. *Cochlostyla rufogaster* MARTENS, Die preussische Expedition nach Ost.-Asien, vol. 2, p. 92, in part.

1890. *Cochlostyla rufogaster* PILSBRY, Man. Conch., ser. 2, vol. 6, p. 207, in part, pl. 43, fig. 27.

1891. *Cochlostyla rufogaster* HIDALGO, Obras Malacologicas, p. 373, in part, pl. 61, fig. 4.

1896. *Orthostyla rufogaster* ELERA, Catalogo sistematico de toda la fauna Filipinas, p. 593, in part.

In this race the shell is elongate-ovate. The aperture is rather flaring and the periphery obtusely angulated. A light zone may or may not be present at the periphery when the periostracum is removed. The peristome is chocolate-brown. The shell differs from *Cochlostyla rufogaster monozona* in being much larger and in having the periphery angulated. It differs from *Cochlostyla rufogaster antipolana* and *Cochlostyla rufogaster montalbana* in being less broadly ovate.

I believe that this race will be found in most collections labeled *Cochlostyla rufogaster.*

Specimens examined.—The type, U.S.N.M. No. 310305, figured, is one of two collected by the Exploring Expedition at Manila. It has 6.3 whorls, and measures: Height, 69 mm; greater diameter, 47.5 mm. The other specimen, U.S.N.M. No. 7611, has 6.2 whorls, and measures: Height: 70.5 mm; greater diameter, 50.7 mm. There are 12 additional specimens in the collection, which undoubtedly belong here, received mostly from the old collectors and labeled Philippine Islands or Luzon. I am not giving measurements of these because specific locality data are missing.

COCHLOSTYLA RUFOGASTER RUFOGASTER (Lesson)

PLATE 83, FIGURES 3, 4; PLATE 84, FIGURE 3

1831. *Helix* (*Bulima*) *rufogaster* LESSON, Illustrations de zoologie, pl. 22.

1837. *Orthostylus rufogaster* BECK, Index molluscorum praesentis aevi musei principis Chr. Frederici, p. 49, no. 6.

1842. *Bulimus rufogaster* PFEIFFER, Symbolae, vol. 3, p. 85.

1846. *Bulimus rufogaster* PFEIFFER, Martini-Chemnitz Conchylien Cabinet, 2d ed., vol. 1, Abth. 12, Theil 2, pp. 164–165, in part.

1848. *Bulimus rufogaster* PFEIFFER, Monographia heliceorum viventium, vol. 11, p. 6, in part.

1849. *Bulimus rufogaster* REEVE, Conchologia Iconica, species 4, in part.

1850. *Bulimus rufogaster* ALBERS, Die Heliceen, 1st ed., p. 135.

1851. *Bulimus rufogaster* DESHAYES, Ferussac's histoire naturelle mollusques, vol. 1, p. 9.

1853. *Bulimus rufogaster* PFEIFFER, Monographia heliceorum viventium, vol. 3, p. 295, in part.

1858. *Cochlostyla rufogaster* H. and A. ADAMS, Genera of recent Mollusca, vol. 2, p. 142.

1859. *Bulimus rufogaster* PFEIFFER, Monographia heliceorum viventium, vol. 4, p. 357.

1859. *Cochlostyla rufogaster* PFEIFFER, Monographia heliceorum viventium, vol. 4, p. 853.

1860. *Orthostyla rufogaster* MARTENS, Albers, Die Heliceen, 2d ed., p. 178.

1867. *Cochlostyla rufogaster* MARTENS, Die preussische Expedition nach Ost.-Asien, vol. 2, p. 92, in part.

1868. *Bulimus rufogaster* PFEIFFER, Monographia heliceorum viventium, vol. 6, p. 6.

1868. *Cochlostyla rufogaster* PFEIFFER, Monographia heliceorum viventium, vol. 6, p. 596.

1874. *Cochlostyla rufogastra* SEMPER, Reisen im Archipel der Philippinen, pt. 2, vol. 3, p. 202, in part.

1876. *Bulimus rufogastra* PFEIFFER, Monographia heliceorum viventium, vol. 8, p. 6.

1876. *Cochlostyla rufogastra* PFEIFFER, Monographia heliceorum viventium, vol. 8, p. 682.

1883. *Cochlostyla rufogastra* PAETEL, Catalog der Conchylien-sammlung, 2d ed., p. 97.

1887. *Cochlostyla rufogaster* HIDALGO, Journ. Conchyl., vol. 35, pp. 160–161, in part.

1890. *Cochlostyla rufogaster* PILSBRY, Man. Conch., ser. 2, vol. 7, p. 207, in part, fig. 7.

1891. *Cochlostyla rufogaster monozona* HIDALGO, Obras Malacologicas, pp. 372–4, in part, pl. 61, fig. 3.

1894. *Helicostyla rufogastra* PILSBRY, Man. Conch., ser. 2, vol. 9, p. 227.

1896. *Orthostyla rufogaster* ELERA, Catalogo sistematico de toda la fauna Filipinas, p. 593, in part.

1898. *Cochlostyla rufogastra* MÖLLENDORFF, Abh. Naturf. Ges. Görlitz, vol. 22, p. 138, in part.

1912. *Cochlostyla rufogastra* MÖLLENDORFF, Kobelt and Winter, Semper's Reisen im Archipel der Philippinen, vol. 10, pt. 14, pp. 286–7, pl. 61, figs. 1, 2, in part.

The only shell in our collection that resembles Lesson's figure (see pl. 83, figs. 3 and 4), is also a worn specimen that I collected at Mariveles, Bataán Province, Luzon (pl. 84, fig. 3). The harbor of Mariveles at the entrance to Manila Bay must have been visited often by sailing vessels in the days of old, and it seems quite possible that the shell described by Lesson from the collection of the Duke of Rivoli may have come from there, and I shall so consider it here. It is also possible that those cited by various authors as coming from Zambales belong here. In fact this seems more than probable, since the Zambales mountain range is faunistically quite distinct, being well separated from the mountains to the east by flat plains regions.

The typical race is elongate-ovate. The early whorls in the decorticated shell are flesh colored, gradually tending toward rufous on the base. There is a conspicuous broad light zone at the periphery, which is well rounded. The peristome is very dark brown.

The elongate, almost conic form, the large size, rounded periphery, and very dark peristome are its distinctive characters.

Remarks.—Lesson gives 3 pouces as the height of the shell, which is equivalent to 81.21 mm; its greater diameter is said to be 21 lignes (=47.38 mm), while the height of the aperture is 19 lignes (=42.86 mm); diameter of aperture, 14 lignes (=31.58 mm).

Our shell, U.S.N.M. No. 256076, has 6.1 whorls, and measures: Height, 74.6 mm; greater diameter, 51.5 mm; height of aperture, 41.4 mm; diameter of aperture, 29.6 mm.

COCHLOSTYLA RUFOGASTER BANAHAOANA, new subspecies

PLATE 85, FIGURE 4

1891. *Cochlostyla rufogaster* HIDALGO, Obras Malacologicas, p. 373, in part.

Shell broadly ovate with a decided angle at the periphery of the last whorl, which may or may not have a yellowish spiral band when denuded of its periostracum. The race is nearest to *Cochlostyla rufogaster montalbana*, but differs from it by having the periphery much more angulated. The interior of the aperture and peristome is also much darker.

Specimens examined.—The type, U.S.N.M. No. 255968, was collected by myself at Majayjay, Santa Cruz Province, Luzon. It has 6.1 whorls, and measures: Height, 73 mm; greater diameter, 52 mm. I have additional immature specimens from the same general region, which agree with the type as far as parallel growth and marking are concerned.

This may be the shell that Hidalgo reports from Lucban, a locality also in the Mount Banahao region.

COCHLOSTYLA RUFOGASTER TOPPINGI, new subspecies

PLATE 85, FIGURE 3

This is the giant race that occupies Mount Maquiling in Laguna Province, Luzon. It is very elongate-ovate in shape. The three specimens before us all lack the light peripheral zone when the periostracum is removed. The periphery is feebly angulated. The peristome is very dark chocolate-brown and the columella is axially streaked with brown. The interior is dark bluish pearly gray.

Specimens examined.—The type, U.S.N.M. No. 310514, was collected by LeRoy Topping at Mount Maquiling. It has 7 whorls, and measures: Height, 91.8 mm; greater diameter, 56 mm. Another specimen, U. S. N. M. No. 311334, from the same locality, collected by Dr. C. F. Baker, also has 7 whorls, and measures: Height, 87.7 mm; greater diameter, 58.4 mm, while a third. U.S.N.M. No. 255864, from the same place, collected by myself, has 6.5 whorls, and measures: Height, 87.5 mm; greater diameter, 56.9 mm.

Remarks.—The huge size alone at once distinguishes this race from all the others.

COCHLOSTYLA RUFOGASTER, subspecies?

A number of immature specimens from localities not embraced specifically in the races here treated indicate by their distinct features that they require subspecific recognition, but this will have to await the arrival of more complete material than that at hand. Very distinct from the races treated seem to be some specimens from Pampanga Province, Sibul Springs, Bulacán Province, and Mount Polio, Banaue, Nueva Vizcaya, a locality unknown to me.

Then, too, the references of the early writers to *Cochlostyla rufogaster* from localities distant from those from which our material has come indicate further collecting and research in these places.

For example, Semper in 1874 in his Reisen im Archipel der Philippinen, reports the species from Baler, which is on the east coast in the northeast corner of Tayabas Province, Luzon, a long distance from any of the races that I recognize. This will undoubtedly prove distinct.

Hidalgo, in his Obras Malacologicas in 1891, reports in addition to many of the recognized races, specimens of *Cochlostyla rufogaster* from Dingalan, Tayabas; La Union (Camarines Sur ?), Pangasinán; Tarlac; Zambales; Morong, Rizal Province and Batangas, from none of which I have seen material. Those cited by him from northern Luzon under this name belong to a distinct species.

Von Möllendorff repeats citing the above in the Abhandlungen der naturforschenden Gesellschaft zu Görlitz in 1898, under the species.

It is to be hoped that these notes will call attention to the need of adequate material from the places mentioned, the securing of which will give us a better understanding of the range of the species and its races.

OBBA MARMORATA AND ITS RACES

A recent sending of a collection of land shells to the National Museum by the Philippine Bureau of Science for identification and report made it necessary to subject *Obba marmorata* to a critical review, with the result that some shifting of older names as usually conceived became necessary, and a number of new zoogeographic races required defining.

OBBA MARMORATA (Von Möllendorff)

This mollusk was described by Von Möllendorff as a subspecies of *Obbina planulata* Lamarck. The large collections in the United States National Museum demonstrate plainly not only that it should be recognized as a distinct species but also that we must recognize a number of zoogeographic races, which are herein defined.

Obba marmorata varies in shape from broadly conic to depressed-helicoid. The last whorl is obscurely angulated at the periphery, and the last half of the turn has a second obscure angulation between this and the summit, the space between the two being somewhat flattened, while the whorl between the summit and first angulation is well rounded. The postnuclear whorls are marked by rather rough, irregular, and retractively curved incremental lines, which in some of the races almost amount to ribs. In addition to these, the surface is marked by irregular and irregularly spaced impressed lines, which are more or less spiral in arrangement on the early turns, but which on the later whorls assume the form of oblique or zigzag wrinkles. The base is always well rounded and openly unbilicated, the umbilicus being partly closed by the reflected inner lip. The peristome is white, thickened, expanded, and reflected. A tooth is present near the middle of the basal lip.

The ground color is flesh color, in some with a yellowish tinge, marbled and variegated with brown. There is a tendency, or even a stronger expression in some races, to the formation of a peripheral, superperipheral, and basal spiral band.

The species ranges from Ilocos Sur south through Benguet, Pangasinan, Nueva Ecija, and Rizal Provinces, Luzon, and the smallest race of the species *Obba marmorata ilinensis*, new subspecies, comes from the little island Ilin south of Mindoro.

KEY TO THE SUBSPECIES OF OBBA MARMORATA VON MÖLLENDORFF

Periphery of last whorl with a decided angle.
  Greater diameter more than 31 mm ---------- **bolinaoana**
  Greater diameter less than 18 mm ---------- **benguetana**
Periphery of last whorl without a decided angle.
  Shell broadly conic.
    Greater diameter more than 35 mm ---------- **marmorata**
    Greater diameter less than 25 mm ---------- **ecijana**
  Shell not broadly conic.
    Shell depressed-helicoid.
      Greater diameter more than 27 mm ---------- **rizalana**
      Greater diameter less than 25 mm ---------- **ilinensis**

OBBA MARMORATA BOLINAOANA, new subspecies

Plate 86, Figure 5

In this race the periphery of the last whorl is decidedly angulated, and the base is much less inflated than in the typical form. It resembles most nearly *Obba marmorata benguetana*, from which it differs by being larger and smoother, in having a larger umbilicus, a much stronger peristome, and a much larger aperture; it also has a much paler color pattern.

Type.—U. S. N. M. No. 116345 has 4.8 whorls, and measures: Height, 17.5 mm; greater diameter, 31.9 mm; lesser diameter, 24.3 mm. It was collected by Cuming at Bolinao, on the northwestern point of Pangasinan Province, Luzon.

OBBA MARMORATA BENGUETANA, new subspecies

Plate 86, Figure 4

This is the smallest known race with the sharp angulation of the periphery and the poorly rounded base. It is much thinner and darker colored than *Obba marmorata bolinaoana.* Its umbilicus and the aperture are smaller, the peristome is much less strongly developed, and the under surface of the last whorl is ever so much more strongly wrinkled.

Type.—U.S.N.M. No. 256484 has 5 whorls, and measures: Height, 13.7 mm; greater diameter, 27.3 mm; lesser diameter, 21.8 mm. It was collected by Dr. E. A. Mearns at an altitude of 5,000 feet at Baguio, Benguet Province, Luzon.

Additional material.—Four topotypes, U.S.N.M. No. 256563, yield the following additional measurements:

Number of whorls	Height	Greater diameter	Lesser diameter
	Millimeters	*Millimeters*	*Millimeters*
5.1	13. 8	16. 2	11. 7
5.0	13. 9	17. 8	11. 9
5.0	14. 0	16. 8	12. 1
4.9	13. 5	15. 9	11. 0

OBBA MARMORATA MARMORATA (Von Möllendorff)

Plate 86, Figure 6

1898. *Obbina planulata marmorata* Von Möllendorff, Abh. Naturf. Ges. Görlitz, vol. 22, p. 85.

1905. *Obbina planulata marmorata* Von Möllendorff, Kobelt and Winter, Semper's Reisen im Archipel der Philippinen, vol. 10, pt. 1, p. 20, pl. 5, fig. 3.

This is the large, comparatively pale, race that Von Möllendorff states (*loc. cit.*) comes from Ilocos Sur, Abra, Benguet, and Tiagan. I suspect that Benguet as given by him is really Bangued in Abra Province, which would make the distribution cited a compact and not a discontinuous one. Our shells from Benguet represent a much smaller race, upon which, had Von Möllendorff possessed specimens, he would not have hesitated to bestow a name.

Specimens examined.—The specimen figured, U.S.N.M. No. 312998, was collected by Quadras on Mount Bulagao, Ilocos Sur, Luzon. It has 4.5 whorls and measures: Height, 18.4 mm; greater diameter, 36.3 mm; lesser diameter, 27.5 mm. Two additional specimens, U.S.N.M. No. 116332, collected by Cuming in "Luzon," have each 4.2 whorls. They measure: Height, 19.5 and 20 mm; greater diameter, 34.9, 35.6, and lesser diameter, 28.2, 27.4 mm, respectively.

OBBA MARMORATA ECIJANA, new subspecies

PLATE 86, FIGURE 1

In this race the periphery of the last whorl is not strongly angulated, but appears as a slender thread. The base is rather inflated and well rounded. The shell is decidedly elevated and broadly conic. The aperture is large and broadly oval. The wrinkles are strongly developed both on the upper and basal surface. In size it approaches *Obba marmorata rizalana*, but it can be at once distinguished from that by its much more elevated spire and coarse wrinkled sculpture, which is almost obsolete in *Obba marmorata rizalana*.

Type.—U.S.N.M. No. 312996 has 5.1 whorls and measures: Height, 18.2 mm; greater diameter, 31.8 mm; lesser diameter, 24.7 mm. It was collected at Lupao, Nueva Ecija, Luzon.

Additional material.—Four topotypes, U.S.N.M. No. 312997, yield the following additional measurements:

Number of whorls	Height	Greater diameter	Lesser diameter
	Millimeters	*Millimeters*	*Millimeters*
5. 1	17. 5	31. 8	24. 8
5. 6	18. 8	29. 9	23. 2
5. 4	16. 7	29. 9	23. 2
5. 4	18. 4	31. 3	24. 4

OBBA MARMORATA RIZALANA, new subspecies

PLATE 86, FIGURE 2

This is a dark-colored race of depressed-helicoid shape. It belongs to the group in which the periphery is not conspicuously angulated and in which the base is slightly inflated and well rounded. The incremental sculpture is almost riblike and decidedly retractively curved on the last whorl, but the impressed wrinkles are only poorly shown. It can be at once distinguished from *Obba marmorata ecijana* by its being decidedly depressed, by having the aperture much smaller and much more narrowly oval, and by having the base almost free from wrinkles.

Type.—U.S.N.M. No. 312999 has 5 whorls, and measures: Height, 14 mm; greater diameter, 28.7 mm; lesser diameter, 22.2 mm. It was collected by F. Juan at Novaliches, Rizal Province, Luzon.

Additional material.—Thirteen topotypes are before me, six of which are U.S.N.M. No. 313000; the other seven will be returned to the Philippine Bureau of Science. These specimens yield the following measurements:

Number of whorls	Height	Greater diameter	Lesser diameter
	Millimeters	*Millimeters*	*Millimeters*
4. 7	13. 0	29. 0	22. 8
5. 0	14. 2	28. 2	21. 8
4. 8	13. 8	28. 2	22. 0
4. 9	14. 3	28. 0	22. 3
4. 8	13. 1	29. 1	22. 6
4. 8	13. 8	27. 3	21. 2
4. 8	13. 3	27. 4	21. 8
4. 8	13. 8	29. 1	22. 6
5. 0	14. 3	28. 9	22. 2
4. 8	13. 4	27. 5	21. 3
4. 9	14. 0	29. 2	22. 4
5. 0	14. 8	28. 5	22. 3
4. 8	14. 1	27. 3	21. 7

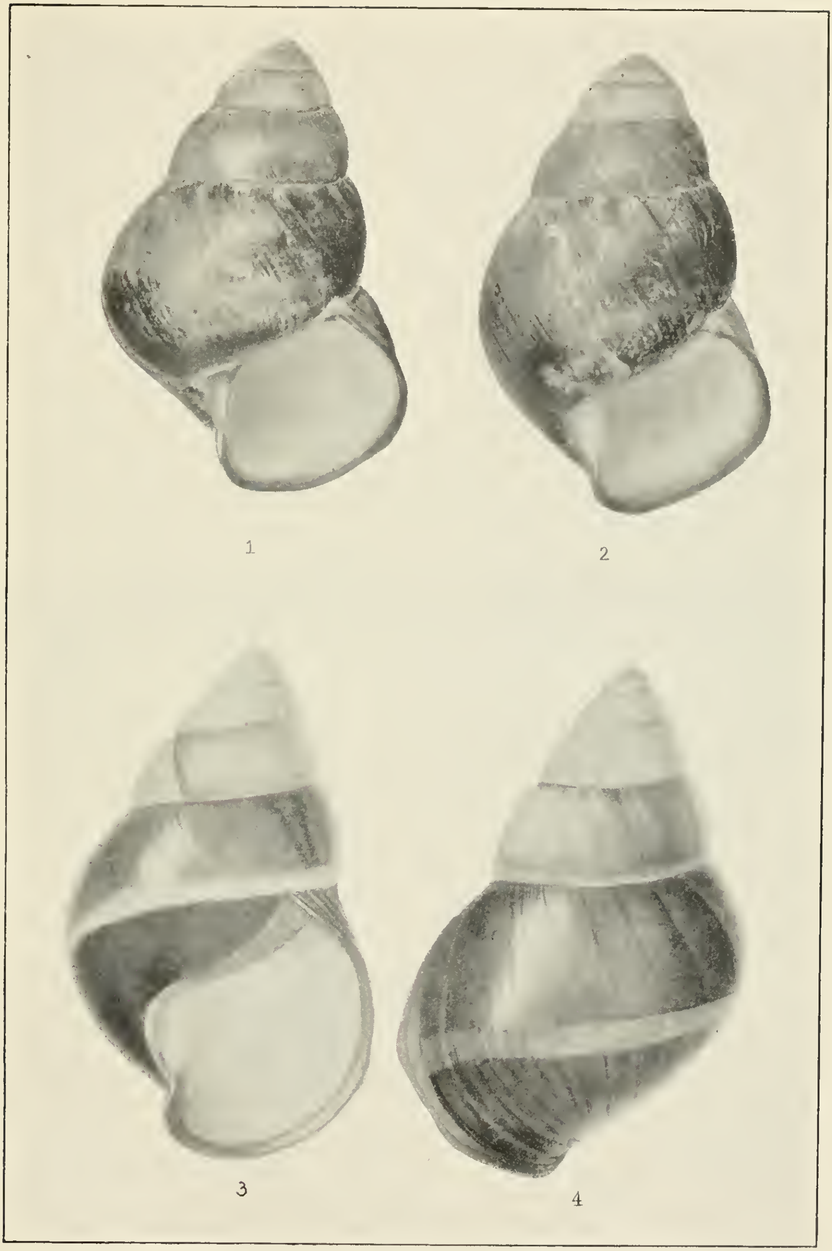
OBBA MARMORATA ILINENSIS, new subspecies

PLATE 86, FIGURE 3

This is the smallest race of this species. Its distribution is rather interesting, and it is quite possible that careful collection in Mindoro will show races of it eventually. It is a pale race, the shell being rather broadly conic. The periphery of the last whorl is rather rounded than angulated, but an obsolete indication of angulation is present. The incremental lines on the upper and lower surface are not so rough as in the other races, and the wrinkling of both surfaces resembles scratches more than the strong wrinkles of some of its other subspecies. The aperture is oval, and moderately broad, and the peristome is strongly expanded and reflected on the outer and basal lips. The umbilicus is narrow and half covered by the reflection of the inner lip.

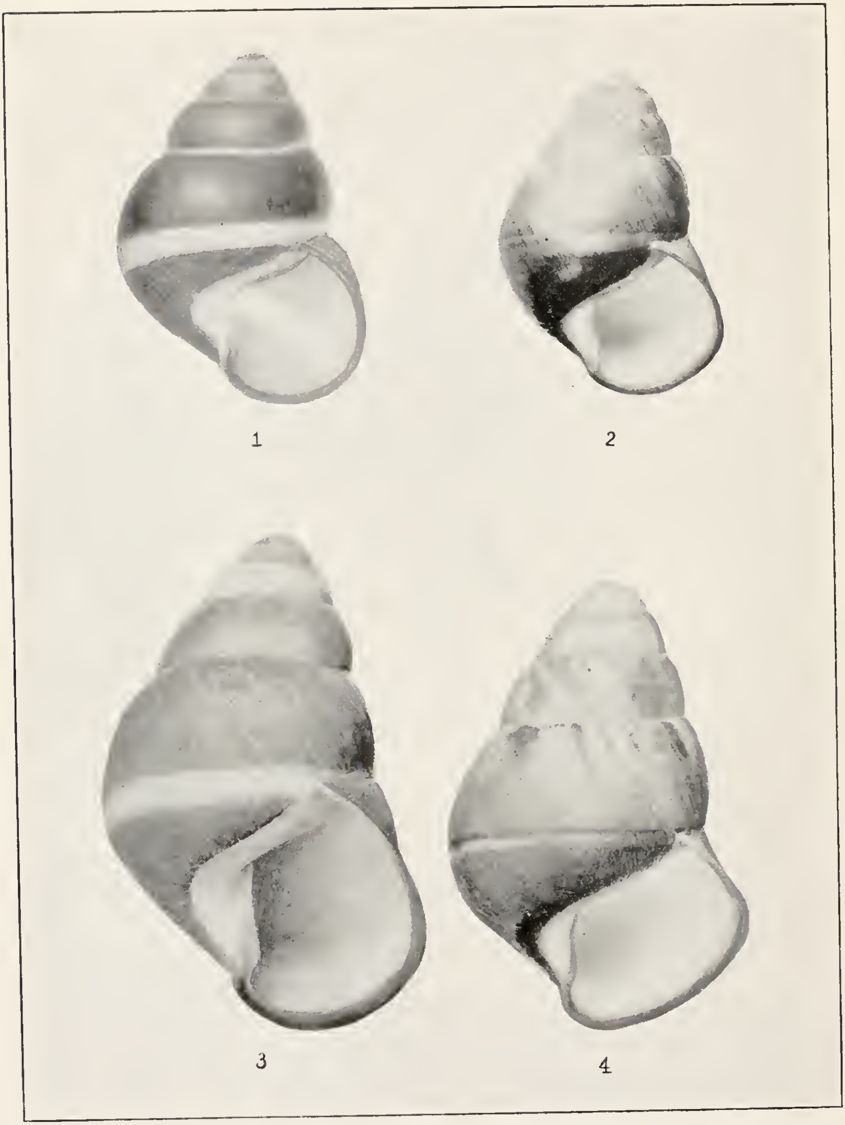
Type.—The unique type, U.S.N.M. No. 313001, was donated by Walter F. Webb. It comes from Ilin Island, which lies a short distance off the south coast of Mindoro. It has 4.8 whorls, and measures: Height, 13 mm; greater diameter, 14.2 mm; lesser diameter, 19 mm.

◆



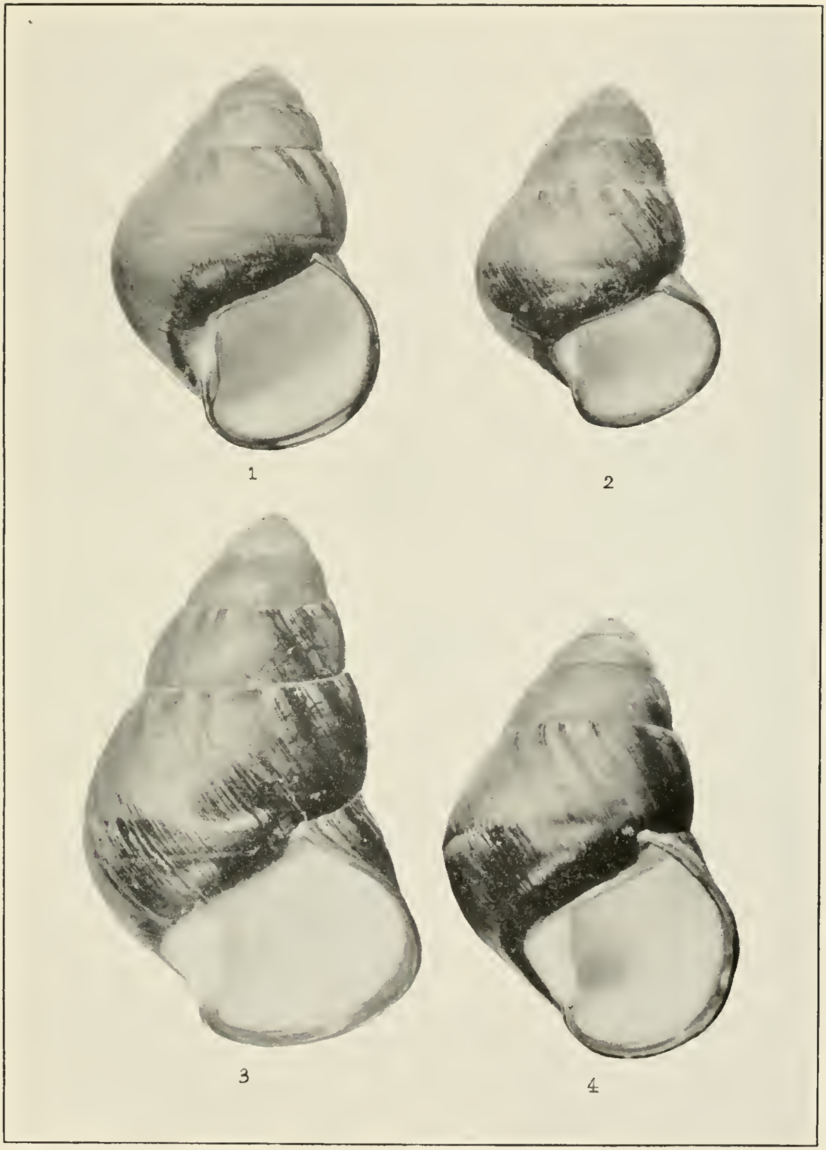
RACES OF COCHLOSTYLA RUFOGASTER

1, *Cochlostyla rufogaster montalbana*; 2, *C. r. benguetana*; 3, 4, *C. r. rufogaster*, copy of Lesson's figure. Slightly reduced.



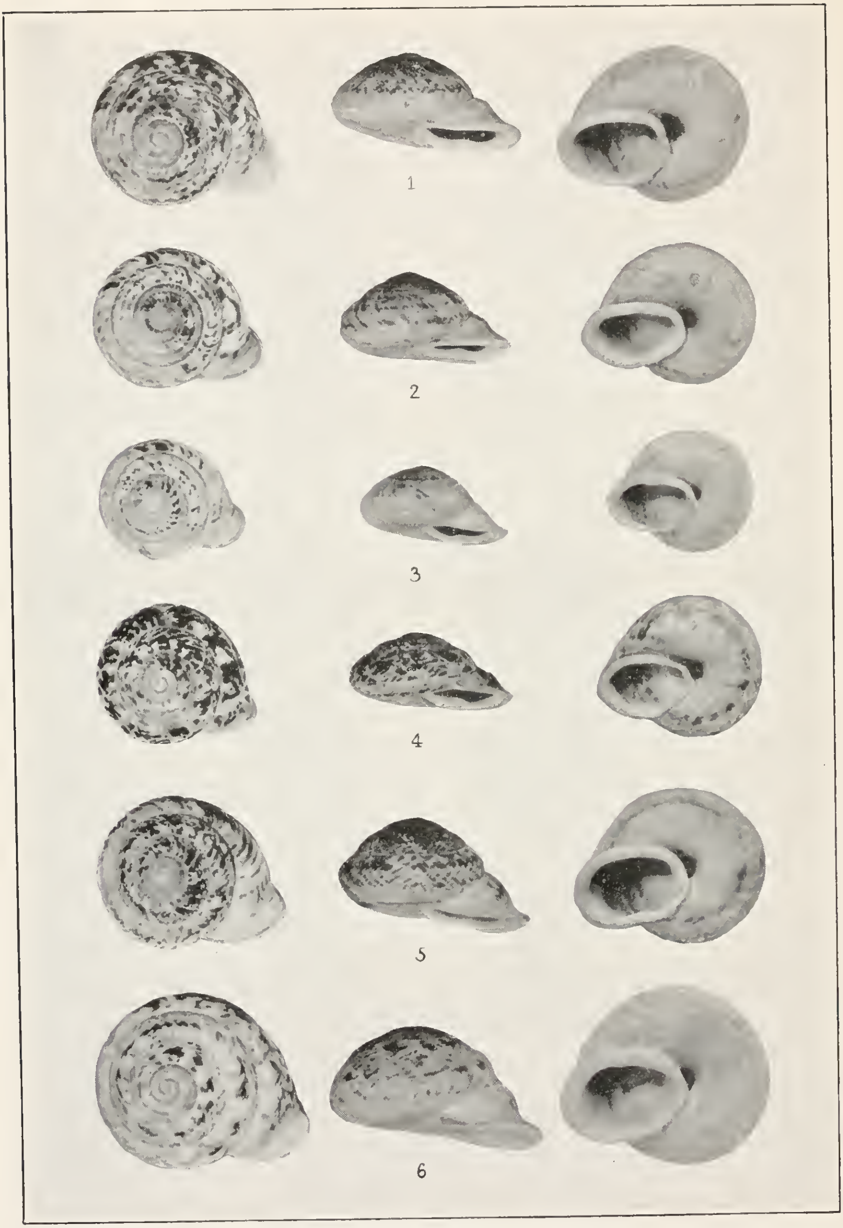
RACES OF COCHLOSTYLA RUFOGASTER

1, *Cochlostyla rufogaster monozona*, copy of Pfeiffer's figure; 2, *C. r. monozona;* 3, *C. r. rufogaster;* 4, *C. r. manilana*. Slightly reduced.



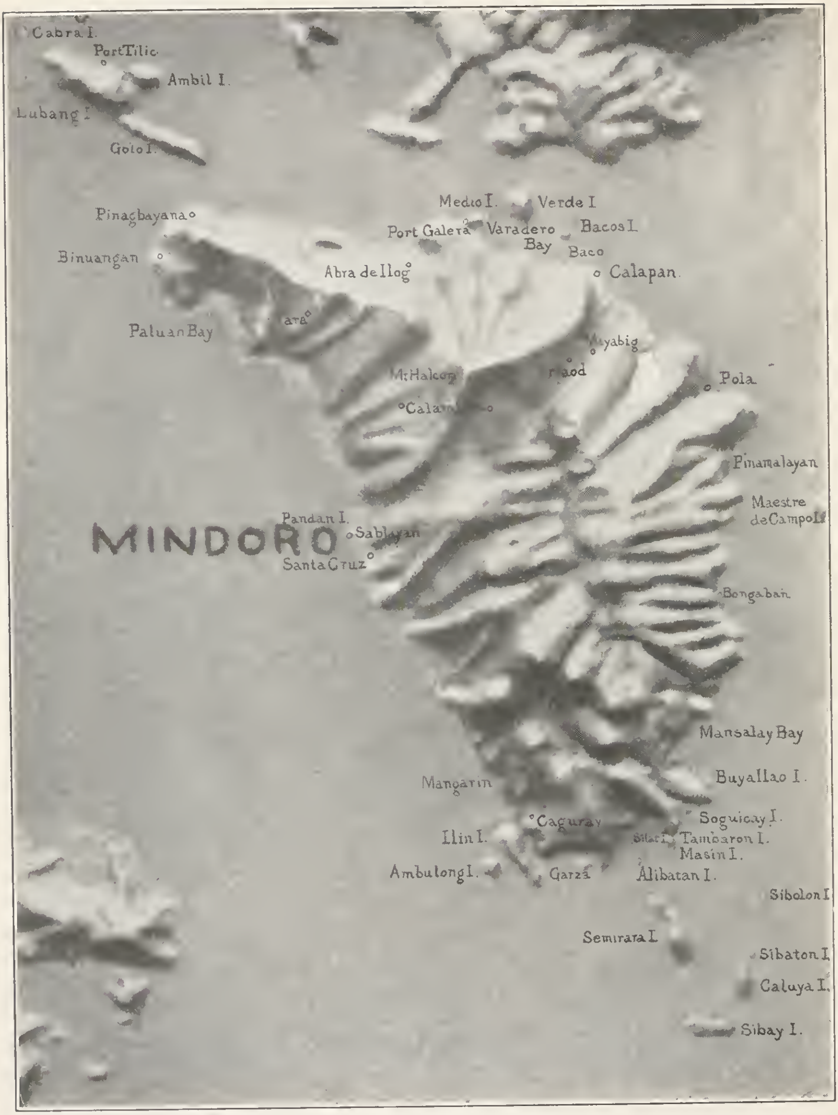
RACES OF COCHLOSTYLA RUFOGASTER

1, *Cochlostyla rufogaster juani;* 2, *C. r. antipolana;* 3, *C. r. toppingi;* 4, *C. r. banahaoana.* Slightly reduced.



OBBA MARMORATA AND ITS RACES

1, *Obba marmorata ecijana;* 2, *O. m. rizalana;* 3, *O. m. ilinensis;* 4, *O. m. benguetana;* 5, *O. m. bolinaoana;* 6, *O. m. marmorata.* Slightly reduced.


Cabra I.
Port Tilic
Ambil I.
Lubang I.
Golo I.
Pinagbayana
Binuangan
Paluan Bay
Medio I.
Verde I.
Port Galera
Varadero Bay
Bacos I.
Baco
Abra de Ilog
Calapan
Mt. Halcon
Pola
Pinamalayan
Maestre de Campo I.
Pandan I.
MINDORO
Sablayan
Santa Cruz
Bongabon
Mansalay Bay
Buyallao I.
Mangarin
Soguicay I.
Caguray
Ilin I.
Tambaron I.
Masin I.
Ambulong I.
Garza
Alibatan I.
Sibolon I.
Semirara I.
Sibaton I.
Caluya I.
Sibay I.

Relief Map of Mindoro Province, Philippine Islands, Showing Localities from which Specimens of Obba were Obtained

THE LAND SHELLS OF THE GENUS OBBA FROM MINDORO PROVINCE, PHILIPPINE ISLANDS

By Paul Bartsch

Curator, Division of Mollusks and Cenozoic Invertebrates, United States National Museum

---

Recent sendings to the United States National Museum of land mollusks from Mindoro Province, Philippine Islands, for identification have made it necessary to subject those belonging to the genus *Obba* to a critical review; the results thereof are expressed in the following pages.

Mindoro Province includes besides the main island a number of lesser isles and islets, and in order to get an adequate understanding of the distribution of the various races of the species here discussed, a relief map is here reproduced (pl. 87). It is hoped that this may stimulate collectors to search for these and other land shells on the small islands from which no mollusks have been reported. Such a search is sure to produce rich results.

KEY TO THE SPECIES OF OBBA REPORTED FROM MINDORO PROVINCE

- Shell acutely keeled at the periphery.
  - Periphery with a dark band ---------- **gallinula.**
  - Periphery without a dark band ---------- **listeri.**
- Shell not acutely keeled at the periphery.
  - Shell angulated or rounded at the periphery.
    - Periphery with a dark zone ---------- **subhorizontalis.**
    - Periphery without a dark zone.
      - Conspicuous brown marking absent ---------- **sarcochroa.**
      - Conspicuous brown marking not absent.
        - Subsutural interrupted brown band present ---------- **mesai.**
        - Subsutural interrupted brown band absent.
          - Upper surface very rough ---------- **marmorata.**
          - Upper surface not very rough.
            - Upper surface rather smooth ---------- **planulata.**

OBBA GALLINULA BARTHELOWI, new subspecies

Plate 88, Figure 1

The shell is lenticular, strongly carinated at the periphery, rather broadly umbilicated. The nuclear whorls are flesh-colored; postnuclear whorls of pale horn-colored ground color with a broad zone halfway between the summit and the periphery, and a rather broader peripheral zone of brown, which extends both on the upper and lower surfaces in equal width and an almost median basal band, which is about twice as wide as that on the spire. In addition to this, the whorls are vermiculated by diaphanous zigzag lines on both the upper and lower surfaces. On the lower surface this element seems confined between the peripheral and median basal dark zones. The peristome is white. The dark bands show on the inside of the outer lip. Nuclear whorls 1.3, marked by fine lines of growth and microscopic spiral striations. The postnuclear whorls are slightly rounded and marked by rather coarse incremental lines and microscopic spiral striations. Both of these elements extend upon the base. In addition to this, the anterior half of the whorls between summit and suture and the equivalent basal portion are rather strongly malleated. The succeeding turns fall below the keeled periphery of the preceding turn, but in such a way as to form an almost continuous slope. The aperture is oval. The peristome is somewhat inbent on the posterior half, while that of the inner lip is expanded and reflected and on the parietal wall covers about one-third of the umbilicus.

Type.—The type, U.S.N.M. No. 256118, was collected by myself on a hillside on the west side of Mansalay Bay. It has 4.6 whorls, and measures: Height, 11 mm; greater diameter, 25.9 mm; lesser diameter, 21 mm.

Remarks.—This race suggests closely *Obba gallinula pagbilaoensis* Bartsch, from which it differs in being a little more lenticular; that is, a little less inflated and smaller.

OBBA LISTERI (Gray)

Martin Lister in his "Historiae sive Synopsis Methodicae Conchyliorum et Tabularum Anatomicarum," published in 1770, figures on Tabula 66 the underside of a shell that is not quite adult, which may well represent this species.

John Edward Gray, in "A List and Description of Shells not Taken Notice of by Lamarck," published in 1825 in the Annals of Philosophy (new ser., vol. 9, p. 412), has the line, "C. Listeri. List. t. 66, fa. 64, Mus. Brit.," which, translated, means that he here names the shell which Lister figured as cited above *Caracolla listeri.*

In 1841, W. J. Broderip published in the Proceedings of the Zoological Society of London (pp. 37, 38) a description of the shell and a discussion of its relationship:

> Helix (Carocolla) Listeri. *Car. testâ complanatâ, umbilicatâ; anfractibus 4, lineis incrementi creberrimè striatis, ultimo maximo acuto; albido-fuscâ maculis brunneis guttatâ, et brunneo uni-fasciatâ; peritremate deorsùm flexo auriculari, albido; labii unidentati margine acuto, anticè lanceolato.*
>
> Long. ⅝; lat. 1⅞ poll.
>
> *Hab.* ad Albay insulae Luzon, truncis arborum haerens.
>
> Legit H. Cuming in sylvis.
>
> Mr. Cuming had named this species *Car. Gallina,* but as it is designated as *Car. Listeri* on the boards of the British Museum, and as Lister appears to have been the first who figured it, but apparently from an imperfect shell, the latter name is retained.

> In colour and in the direction of the form and shape of the aperture it bears much resemblance to *Helix auriculata*, figured by Mr. Swainson (Zoological Illustrations, 1st series) from a specimen formerly in the cabinet of Mr. C. Dubois, afterwards in mine, and now in the British Museum; but in *H. auriculata* the whorls are comparatively rounded, and the body-whorl is quite round instead of having a sharp edge. *H. auriculata* is besides, in many individuals, dimpled with small depressions. These differences may be sufficient in the present state of our knowledge to constitute specific distinction; but whether they are in reality strong enough to form such a separation, may well be doubted. My present impression is, that *H. auriculata* and *H. Listeri* are identical; but I shall return to this subject when I have examined the whole of the cognate series in Mr. Cuming's collection.

Since he here cites Albay, Luzon, as the home of the species, I shall follow this dictum and consider this the habitat for the restricted typical subspecies. I am giving on Plate 88, Figure 5, photographs of three views of a typical specimen from Albay.

Obba listeri occupies a very wide range in the Philippine Archipelago, and, like most widely distributed species, it breaks up into a host of races, each of which occupies a limited zoogeographical horizon. From the Mindoro Province I have no less than nine before me, which I shall designate as subspecies. I believe that this is by no means all the races of this species that will eventually have to be recognized, for there are still a number of small islands within the area under discussion from which no Obbas are as yet known, and even the large island of Mindoro seems inadequately explored as evidenced by the few spots from which material is at hand. The unexplored reaches may therefore properly be expected to yield more members of this species.

KEY TO THE SUBSPECIES OF OBBA LISTERI

- Last whorl strongly malleated.
  - Axial sculpture riblike.................................... **sibolonensis.**
  - Axial sculpture not riblike.
    - Incised spiral lines of upper surface very strong.......... **campoensis.**
    - Incised spiral lines of upper surface not very strong.
      - Shell lenticular.................................... **halcona.**
      - Shell not lenticular.
        - Shell depressed-helicoid.
          - Shell pale and small............................ **minor.**
          - Shell dark and large............................ **mayabigana.**
- Last whorl not strongly malleated.
  - Last whorl acutely keeled.
    - Malleations absent on base................................ **smithi.**
    - Malleations present on base............................... **recurvata.**
  - Last whorl not acutely keeled.
    - Last whorl acutely angled.
      - Malleations present on base.......................... **caloocana.**
      - Malleations not present on base...................... **subplanulata.**

OBBA LISTERI SIBOLONENSIS, new subspecies

PLATE 88, FIGURE 2

The shell is small, depressed-helicoid, with an acute peripheral keel. The nuclear whorls 2, pale brown. The first half of the postnuclear whorls is of the same color as the nuclear turns; the rest are of buffish tinged flesh-colored ground color, streaked, spotted, and mottled with brown. An ill-defined median interrupted brown band is present on all the turns. The base is of pale buff ground color with a well-developed brown spiral band two-thirds of the distance between the periphery and the umbilicus anterior to the periphery. The depressed malleations are also brown and give to the posterior half of the underside of the last whorl a peculiar mottled appearance. The nuclear whorls are marked by rather strong incremental lines and microscopic spiral striations. The postnuclear whorls are strongly keeled at the periphery and the succeeding turns falling below the keel allow this to show as a slender band at the suture. They are marked by strong riblike axial incremental elements and are heavily malleated on the anterior two-thirds between the summit and the suture. In addition to this, fine microscopic spiral striations are present on the spire and also a still finer network of crisscross striations. The basal surface is marked by the continuations of the axial riblike elements and rather strong malleations, which extend from the periphery almost to the umbilical edge. In addition to this, rather strong spiral striations are present, much stronger than those on the upper surface and also the crisscross finer sculpture referred to above. Aperture broadly oval; peristome thickened and reflected, covering one-third of the umbilicus at the parietal wall.

Type.—The type, U.S.N.M. No. 382924, and five topotypes, U.S.N.M. No. 382925, were collected by C. Canonizado on Sibolon Island off southeastern Mindoro. The type has 4.5 whorls, and measures: Height, 11 mm; greater diameter, 24.7 mm; lesser diameter, 20.3 mm.

Remarks.—The other five specimens yield the following measurements:

Number of whorls	Height	Greater diameter	Lesser diameter
	Mm	*Mm*	*Mm*
4.5	9. 3	22. 7	19. 4
4.5	10. 0	23. 1	20. 0
4.6	10. 8	22. 7	19. 0
4.6	10. 9	24. 8	20. 7
4.5	10. 9	25. 3	21. 2

This subspecies can at once be distinguished from all the other members of the Province by the riblike axial sculpture.

OBBA LISTERI CAMPOENSIS, new subspecies

Plate 88, Figure 4

Shell helicoid, broadly conic with an acute peripheral keel. The two nuclear whorls are uniform pale brown and marked by fine incremental lines. The remaining whorls are of brown ground color, which becomes intensified on the succeeding whorls. This ground color is broken up by areas of soiled flesh color, pale yellow, or buff, and in spots almost pale orange, which blotch, streak, and fulgurate the upper surface. In addition to this, the postnuclear whorls are marked by a rather broad spiral brown band, the basal portion of which marks the median portion of the turns between the summit and the periphery. The base is of yellowish buff ground color. There is a broad, more or less interrupted and irregular band of bright brown about one-third of the distance between the periphery and the umbilicus. The malleations between this and the periphery and also those between the periphery and the umbilicus are of a paler shade of brown. Peristome flesh-colored, tinged with brown. Interior of outer lip brown with a purplish tinge, darker at the bands described for the outside. The postnuclear whorls are very strongly malleated; the malleations extend over the entire upper surface, while on the base they become weaker toward the umbilicus. In addition to the strong malleations, the whorls are marked by irregular incremental lines and very strong incised spiral lines, which are best shown on the next to the last turn. On the base they are best expressed in the umbilicus and adjacent area, being decidedly obscured toward the periphery by the malleations. The aperture is ovate; the peristome is rather strongly thickened and reflected, covering about one-third of the umbilicus at the parietal wall. The inner lip bears a slender tooth on its middle.

Type.—The type, U.S.N.M. No. 382926, was collected by C. Canonizado, of the Philippine Bureau of Science, at Maestre de Campo Island off east-central Mindoro. It has 4.5 whorls, and measures: Height, 14.7 mm; greater diameter, 31.3 mm.; lesser diameter, 25.8 mm.

Remarks.—Four additional specimens from the same island yield the following measurements:

U.S.N.M. No.	Number of whorls	Height	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
382927 (topotypes)	5. 0	13. 8	30. 3	25. 0
	4. 8	12. 9	29. 8	24. 9
	4. 8	13. 3	31. 4	25. 9
382928	4. 7	14. 0	29. 8	24. 3

This subspecies resembles most nearly *Obba listeri mayabigana* from Mindoro, from which it differs in being much more elevated and in having the malleations on the base extending far nearer the umbilicus. *O. l. mayabigana* also has a decided, fine, crisscross sculpture, which appears to be absent in the present race.

OBBA LISTERI HALCONA, new subspecies

PLATE 88, FIGURE 3

The shell is decidedly depressed-lenticular with a very acute peripheral keel and a broad, open umbilicus. The nuclear whorls are flesh-colored; the postnuclear whorls are decidedly mottled, spotted, and streaked with flesh color, pale brown, darker brown, orange, and variations of these elements. A supramedian brown band encircles the whorls on the upper surface. The base is rather inflated, yellowish buff with a broad bright chestnut-colored band, which is a little posterior to the middle between the periphery and the umbilicus. The peristome is white with a buffish tinge. The inside of the outer lip is very pale brown. The first postnuclear whorl is marked by incremental lines and rather weak spiral striations; the remaining turns are malleated, a little less strongly near the summit than the periphery. They are also marked by strong incremental lines and rather feebly incised spiral lines. The base slopes from near the umbilicus to the acute periphery and is malleated to the edge of the umbilicus, the malleations being stronger toward the periphery. It is also marked by incremental lines and fine spiral striations. The latter are best expressed about the umbilical area. Aperture somewhat polygonal, very broad, with a decided dent at the peripheral angle. Peristome thickened and reflected, covering about one-fourth of the umbilicus. The inner lip with a conspicuous tooth on its middle.

Type.—The type, U.S.N.M. No. 382929, was collected by Col. Edgar A. Mearns on Mount Halcon during his expedition to that mountain in Mindoro. It has 4 whorls, and measures: Height, 9.9 mm; greater diameter, 27.4 mm; lesser diameter, 22.8 mm.

Remarks.—There are two additional fragments obtained on the same expedition in our collection. They are registered as U.S.N.M. Nos. 256542 and 256503.

This subspecies differs from all the other members of the region by its depressed-lenticular form and the width of its umbilicus.

OBBA LISTERI MINOR (Möllendorff)

PLATE 89, FIGURE 2

1898. *Obbina listeri minor* MÖLLENDORFF, nom. nud., Abh. Naturf. Ges. Görlitz, vol. 22, p. 86, in part.

1905. *Obbina listeri minor* MÖLLENDORFF, KOBELT, and WINTER, Semper's Reisen im Archipel der Philippinen, vol. 10, pt. 1, p. 22, in part, pl. 6, fig. 2.

While the two references cited above report this subspecies from Mindoro, Tablas, Romblon, and Sibuyan Islands, I wish now to restrict it to Mindoro. Good and sufficient characters are to be found in the abundant material before me from the other islands to warrant their subspecific separation, which will be done at some future time.

The shell is depressed-helicoid with an acute peripheral keel and moderately broad umbilicus. The nuclear whorls are flesh-colored with a buffish tinge. The postnuclear turns are of flesh-colored ground color, mottled, streaked, and variegated with various shades of chestnut-brown. The base is flesh-colored and marked by a broad interrupted spiral band of brown about one-third of the distance between the umbilicus and the periphery anterior to the periphery. In addition to this, the malleations of the base are marked by a weak wash of brown. The peristome is white and the inside of the outer lip dusky brown with the darker band of darker color showing through as a darker zone. The nuclear whorls are marked by fine incremental lines and fine spiral striations, while the postnuclear turns are also marked by rather strong incremental lines and moderately strong incised spiral lines. They are also strongly malleated, the malleations extending almost to the summit of the turns. In addition to this, the surface is marked by very fine crisscross sculpture, which is best expressed immediately behind the aperture. The base is moderately convex, marked by moderately strong incremental lines and moderately strong spiral striations, which are best expressed in the umbilical area. In addition to this, it is covered with very strong malleations, which extend from the periphery to the edge of the umbilicus. The aperture is oval; the peristome is broadly expanded and reflected, covering about one-third of the umbilicus at the parietal wall. The inner lip bears a broad tooth on its middle.

The present subspecies is represented in our collection by two specimens from the Cuming collection, U.S.N.M. No. 116910. These come from Mindoro without specific locality. They give the following measurements:

Number of whorls	Height	Greater diameter	Lesser diameter
	Mm	*Mm*	*Mm*
4.7	10. 8	28. 0	23. 2
4.7	12. 2	27. 6	13. 0

The present subspecies belongs to the strongly sculptured group. It resembles *O. l. campoensis*, from which it can at once be distinguished by its much smaller size and paler coloration.

OBBA LISTERI MAYABIGANA, new subspecies

Plate 89, Figure 1

The shell is rather large, depressed-helicoid, and acutely keeled at the periphery. The nuclear whorls are of soiled flesh-color. The ground color of the rest of the shell is also of this tint, but tinged with buff. In addition to this, the upper surface of the whorls is variegated and blotched and spotted with brown, among which the ground color appears more or less in the shape of fulgurations. There is a supramedian interrupted line of brown. The base is pale yellow with an interrupted band of brown about one-third of the distance between the periphery and the umbilicus anterior to the periphery. The malleations between this brown band and the periphery are of a paler shade of brown. The peristome is soiled white, and the interior of the aperture is brown with a purplish tinge. The nuclear whorls are marked with fine incremental lines and microscopic spiral striations. The postnuclear whorls are strongly malleated, the malleations extending to the summit. In addition to this, they are marked by strong incremental lines and fine crisscross sculpture, which is best shown behind the aperture of the last turn. The base is marked by the continuation of the incremental lines and rather strong malleations, which extend about halfway between the periphery and the umbilicus, the umbilical portion being marked by incised spiral lines. The aperture is irregularly oval; the peristome is expanded and reflected, covering about one-third the umbilicus. The inner lip bears a conspicuous tooth.

Type.—The type, U.S.N.M. No. 322930, was collected by Pedro de Mesa at Mayabig, Baco, Mindoro. It has 4.9 whorls, and measures: Height, 13 mm; greater diameter, 33.3 mm; lesser diameter, 26.4 mm.

Remarks.—Thirteen topotypes, U.S.N.M. No. 382931, yield the following measurements:

	Number of whorls	Height	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
	4. 8	12. 6	29. 9	25. 3
	5. 0	13. 2	33. 5	27. 3
	4. 8	15. 2	31. 6	25. 6
	4. 8	13. 8	29. 7	24. 6
	5. 0	14. 5	32. 1	26. 0
	4. 9	13. 6	31. 8	25. 2
	5. 0	15. 8	32. 0	26. 1
	4. 8	13. 4	30. 0	24. 3
	5. 0	15. 2	31. 5	25. 8
	4. 9	13. 3	32. 1	26. 0
	4. 9	13. 3	30. 8	25. 5
	5. 0	16. 1	33. 7	26. 4
	5. 1	13. 5	33. 1	26. 5
Average	4. 923	14. 115	31. 677	25. 738
Greatest	5. 1	16. 1	33. 7	27. 3
Least	4. 8	12. 6	29. 7	24. 3

This subspecies recalls *O. l. campoensis*, but it is much less elevated and differs in having the malleations on the base approaching the umbilicus to a much lesser degree.

OBBA LISTERI SMITHI, new subspecies

Plate 89, Figure 5

The shell is large, lenticular, and acutely keeled at the periphery with a narrow umbilicus. The coloration of the unique type, which is a dead specimen, is problematical. It is flesh-colored with an interrupted median band of blotches on each turn. There is also a narrow interrupted band on the basal surface, about one-third of the distance between the periphery and the umbilicus. The nuclear whorls are well rounded, marked by fine incremental lines and microscopic spiral striations. The postnuclear whorls are rather flattened on the upper surface and decidedly keeled, the succeeding turns falling below the keel. They are marked by retractively curved incremental lines and spiral striations, which increase in size on the turns, and on the last whorl behind the aperture become exceedingly strongly incised. What there is of malleation on the upper surface is very weakly expressed. The base is slightly convex, marked by incremental lines and spiral striations, which are a little stronger toward the periphery than toward the umbilicus, and are most strongly developed immediately behind the aperture. The aperture is oval, with the perisome expanded, thickened, and reflected to cover about one-third of the umbilicus.

Type.—The type, U.S.N.M. No. 256413, was collected by the writer at Port Tilig, Lubang Island. It has 4.5 whorls, and measures: Height, 12.5 mm; greater diameter, 35.3 mm; lesser diameter, 28.2 mm.

Remarks.—This is one of the most aberrant members of the *listeri* complex. Its exceedingly strong incised spiral lines behind the aperture separate it from all the other members of the group.

I take pleasure in naming this subspecies for Dr. Hugh M. Smith, who was deputy commissioner of the United States Bureau of Fisheries and director of the United States Bureau of Fisheries *Albatross* Expedition to the Philippine Islands.

OBBA LISTERI RECURVATA (Möllendorff)

Plate 89, Figures 3, 4

1896. *Obba listeri* var. *scalaris* Elera, nom. nud., Catalogo sistematico de toda la fauna Filipinas, vol. 3, p. 522.

1898. *Obbina listeri recurvata* Möllendorff, Abh. Naturf. Ges. Görlitz, vol. 22, p. 86.

1898. *Obbina listeri recurvata* var. *subscalaris* Möllendorff, Abh. Naturf. Ges. Görlitz, vol. 22, p. 86.

1905. *Obbina listeri recurvata* Möllendorff, Kobelt, and Winter, Semper's Reisen im Archipel der Philippinen, vol. 10, pt. 1, pp. 22–23, pl. 6, figs. 3, 4.

The shell is depressed-helicoid, almost lenticular. The early whorls are flesh-colored, while the succeeding turns have the ground color flesh-colored with a buffish tinge. The postnuclear whorls are, in addition to this, blotched, spotted, and streaked with chestnut-brown, the spotting forming more or less of an interrupted median band. The base also has an interrupted spiral band of dots about two-fifths of the distance between the periphery and the umbilicus. The malleations on the basal side are also darker tinged. The peristome is flesh-colored with a dusky tinge, while the outer lip is a little darker with the darker streaks of the outside showing through conspicuously. In this subspecies we have an enormous variation both as to size and the curving of the peripheral keel. In some individuals the succeeding turns fall far below the peripheral keel and produce a decidedly scalariform effect. The peripheral keel may jut out in a perfectly straight fashion or it may be upturned at the edge. All in all, there is a greater range of variation here than I have observed anywhere else in the genus *Obba*. The nuclear sculpture consists of fine incremental lines and microscopic spiral striations, while the postnuclear whorls have the basal half malleated and the whole surface marked by rather strong incremental lines and slender incised spiral lines. In addition to this, there is a conspicuous crisscross sculpture best developed on the last portion of the last whorl. The base is somewhat inflated with rather feeble incremental lines and moderately well-incised spiral striations. This also has malleations between the brown band and the periphery, and is likewise provided with a strong crisscross sculpture. The aperture is oval with the peristome quite strongly expanded and reflected, covering about one-third of the umbilicus. All our specimens are from the Island of

	Number of whorls	Height	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
	[1]4.8	[1]8.6	[1]17.7	[1]14.8
	4.8	9.6	22.6	18.1
	4.9	11.9	25.4	20.5
	4.8	8.7	22.0	18.5
	4.8	10.5	24.6	19.8
	5.0	11.8	28.7	22.6
	4.9	11.6	24.1	19.1
	5.0	11.0	24.5	19.6
	4.8	10.0	22.0	18.2
	5.1	12.0	24.6	20.3
	4.8	10.6	25.6	19.8
	4.7	8.6	20.1	16.3
	4.9	8.4	19.8	16.1
Average	4.87	10.25	23.207	18.746
Greatest	5.1	12.0	28.7	22.6
Least	4.7	8.4	17.7	14.8

---

[1] Type.

Lubang. Six are recorded as U.S.N.M. No. 195646, of which the specimen figured has 5 whorls, and measures: Height, 11 mm; greater diameter, 24.5 mm; lesser diameter, 19.6 mm. The scalariform specimen that we have figured has 4.9 whorls, and measures: Height, 8.4 mm; greater diameter, 19.8 mm; lesser diameter, 16.1 mm. The remaining 12 specimens yield measurements as given in the table on the opposite page.

This subspecies, owing to its great variation in size and its peculiar scalariform tendencies, of which indications are shown even in specimens that do not have an elevated or scalariform spire, is readily differentiated from all the others. The scalariform variations were noted by von Möllendorff as cited, under the name of *subscalaris*, and Elera probably had the same in mind when he used the name *scalaris*.

OBBA LISTERI CALOOCANA, new subspecies

PLATE 90, FIGURE 1

The shell is small, depressed-helicoid, almost lenticular, with an acute angle at the periphery. The nuclear whorls are pale brown; the succeeding whorls flesh-colored, spotted with blotches and streaks of brown, of which one series forms a median interrupted band and a second less conspicuous spiral zone between this and the summit. The base is pale yellowish with a conspicuous interrupted spiral band about one-third of the distance between the periphery and the umbilicus anterior to the periphery. The early postnuclear whorls are acutely keeled, and the summit of the succeeding turns falls immediately below the periphery. They are marked by moderately strong, retractively curved incremental lines and rather conspicuous incised spiral lines. Likewise are they marked by inconspicuous malleations on the anterior half. These malleations are not present on the last half of the last turn, but they are present immediately below the periphery on the base, although here also but weakly expressed. The fine crisscross sculpture is present on both spire and base, and is best shown immediately behind the aperture. The base is marked by the continuation of the axial riblets and moderately strong incised spiral lines. The aperture is oval; the peristome is strong, thickened, and reflected, covering about one-third of the umbilicus.

Type.—The type, U.S.N.M. No. 382934, comes from Caloocan, Mansalay, Mindoro. It has 4.8 whorls, and measures: Height, 11.9 mm; greater diameter, 27.7 mm; lesser diameter, 12.3 mm.

Remarks.—This subspecies resembles most nearly *Obba listeri subplanulata* Möllendorff from Ambil Island. Like that it has a decided peripheral angle, but not the usual extremely acute keel present in *Obba listeri*. It has the conspicuous colored banding of

O. l. subplanulata both on the upper and lower surfaces, which suggests *Obba mesai*, but it differs from *O. l. subplanulata* in having the whorls more inflated, in having a broader umbilicus, and in having malleations on both the upper and lower surfaces.

OBBA LISTERI SUBPLANULATA (Möllendorff)

PLATE 90, FIGURE 2

1898. *Obbina listeri subplanulata* MÖLLENDORFF, Abh. Naturf. Ges. Görlitz, vol. 22, p. 86.

1905. *Obbina listeri subplanulata* MÖLLENDORFF, KOBELT, and WINTER, Semper's Reisen im Archipel der Philippinen, vol. 10, pt. 1, p. 23, pl. 6, fig. 7.

The shell is small, not acutely keeled at the periphery, but rather strongly angulated. The nuclear whorls are pale brown; the postnuclear whorls are of pale buff color with a series of rather large, irregular, chestnut-brown spots midway between the summit and the periphery of the turns, and a less conspicuous band halfway between this and the summit. There are other lesser blotches also present on the upper surface. The base is pale yellow, marked with a broad interrupted band of brown spots about one-third of the distance between the periphery and the umbilicus anterior to the periphery. The peristome is white, while the interior of the outer lip is pale brown with the external bands showing darker through the substance of the shell. The nuclear whorls are marked by fine incremental lines and microscopic spiral striations. In the postnuclear whorls the incremental lines and spiral striations become stronger except on the last whorl, where the latter element somewhat weakens and where the conspicuous crisscross sculpture presents itself. The incremental lines extend on the lower surface, which is also marked by fine spiral striations and crisscross sculpture. The aperture is rather broadly ovate with the peristome expanded and reflected to cover one-third of the umbilicus. There is a conspicuous broad fold on the inside of the inner lip.

The specimen described and figured, U.S.N.M. No. 382933, comes from the Quadras collection and was collected on Ambil Island, the type locality for this subspecies. It has 4.7 whorls, and measures: Height, 11.5 mm; greater diameter, 28.1 mm; lesser diameter, 23.1 mm.

This subspecies strongly suggests the *Obba mesai* group in the conspicuous spotting of the interrupted spiral bands of the base. It differs from the members of this group by the much more strongly angulated periphery. In this respect it is much more closely allied to *Obba listeri*. It is nearest related to *O. l. caloocana* from Caloocan, from which it can at once be distinguished by the absence of the malleations on the base.

OBBA SUBHORIZONTALIS RADCLIFFEI, new subspecies

PLATE 90, FIGURE 3

While collecting on a hill bordering the shore of Mansalay Bay, Mindoro, I found an *Obba* that resembles *O. subhorizontalis* in such a remarkable way that had it come from the island of Sibuyan, the type locality for the typical race, I would unhesitatingly have referred it here. The separation of locality has caused me to subject it to the most critical examination, with the result that I find that the base of this shell is a little less rounded than that of the typical subspecies, and the umbilicus is a little wider. There are also spiral striations present on the anterior half of the base and in the umbilicus, which I have not been able to observe in the typical race. I believe that these are good and sufficient characters to consider this distinct from *Obba subhorizontalis subhorizontalis.*

Type.—The type, U.S.N.M. No. 256501, has 4.3 whorls, and measures: Height, 12 mm; greater diameter, 27.8 mm; lesser diameter, 22.6 mm.

Remarks.—I take pleasure in naming this race for Dr. Lewis Radcliffe, deputy commissioner of the United States Bureau of Fisheries, who was a member of our scientific staff during the United States Bureau of Fisheries *Albatross* Expedition to the Philippine Islands.

OBBA SARCOCHROA ILOGANA, new subspecies

PLATE 90, FIGURE 5

The shell is broadly conic and has a decided peripheral angle. The umbilicus is half closed by the reflected inner lip. The general ground color is soiled flesh-color. On the upper surface there is a slender median brown thread, which extends from the end of the nuclear whorls to the last turn; on the latter it is absent. In addition to the median brown band, the first 2.3 postnuclear whorls are marked with a second less conspicuous spiral zone a little below the summit. The first 1.5 postnuclear whorls are also much darker than the rest. In addition to the spiral bands, the whorls are more or less mottled with scattered faint blotches and axial streaks of brown on the upper surface. The base is uniformly soiled flesh-color, while the peristome is pale brown tinged with buff. The nuclear whorls are marked by faint incremental lines and spiral striations. On the postnuclear whorls both of these elements become a little intensified except on the last whorl, where enfeebling again takes place, at least in the spiral striations. The basal third of the penultimate whorls also shows an irregular scratchy crisscross sculpture, which gives to that portion of the whorl a somewhat malleated appearance. The base is slightly rounded and marked by incremental lines and rather regularly spaced, well-incised, wavy, spiral striations. The aperture is oval with the peristome very strongly developed, expanded, thickened, and reflected, covering half of the umbilicus.

The type and eight specimens were collected by Pedro de Mesa at Tara, Abra de Ilog, northern Mindoro, Philippine Islands.

Type.—The type, U.S.N.M. No. 382700, has 4.9 whorls, and measures: Altitude 17.7 mm; greater diameter, 28.9 mm; lesser diameter, 23.3 mm.

Remarks.—The other eight specimens yield the following measurements:

	Number of whorls	Height	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
	4. 9	18. 6	31. 0	24. 2
	[1] 4. 9	[1] 17. 7	[1] 28. 9	[1] 23. 3
	5. 0	17. 3	30. 1	23. 3
	5. 0	15. 6	28. 5	22. 8
	5. 0	17. 1	28. 7	23. 4
	4. 8	14. 9	28. 3	22. 5
	5. 2	16. 0	28. 1	23. 1
	4. 8	18. 0	31. 0	25. 0
	5. 1	14. 1	28. 3	22. 0
Average	4. 967	16. 59	29. 21	23. 18
Greatest	5. 2	18. 6	31. 0	25. 0
Least	4. 8	14. 1	28. 1	22. 0

[1] Type.

The present race can at once be distinguished from *Obba sarcochroa sarcochroa* Möllendorff by the smaller size and much flatter shape.

OBBA MESAI, new species

Shell lenticular, umbilicated, pale buff or flesh-colored, with the upper surface marbled and variegated with brown; the lower surface with an interrupted band of brown at some little distance anterior to the periphery. Peristome white or pale buff. Basal lip provided with a poorly developed median tooth. Periphery of last whorl obsoletely angled. The upper surface behind aperture is marked, in addition to incremental and fine spiral lines, by two sets of very regular microscopic incised lines, which are at right angles to each other and which cut the lines of growth obliquely. I shall call these crisscross lines in the key to the subspecies.

This species differs from *Obba listeri* in having the periphery scarcely at all angulated, a character usually very pronounced in that species. In the inflation and rounding of the periphery it resembles *Obba planulata* more closely, from which the conspicuous interrupted basal band will at once distinguish it.

The races recognized here are from the islands of Lubang, Ilin, and probably southern Mindoro.

The species is named for Pedro de Mesa, whose fine sending of the typical races stimulated the present revision.

KEY TO SUBSPECIES OF OBBA MESAI

Crisscross lines rather strongly developed on upper surface.	
Crisscross sculpture on lower surface strong	sablayana.
Crisscross sculpture on lower surface obsolete	richi.
Crisscross lines feebly developed on upper surface.	
Spiral striations strong	mesai.
Spiral striations obsolete	johnsoni.

OBBA MESAI SABLAYANA, new subspecies

Plate 91, Figure 3

The early whorls are of flesh-colored ground color; the later ones are straw-colored, as is also the base. The interrupted dark zones and mottlings occupy the major portion of the upper surface of the shell, and are dark chestnut-brown; brighter on the early turns. The peristome is soiled pale buff. Crisscross sculpture strongly developed on both the upper and lower surfaces. The spiral striations are almost obsolete on the upper surface of the last half of the last whorl and only feebly expressed on the lower surface.

Type.—The type, U.S.N.M. No. 382697, was collected on the United States Bureau of Fisheries *Albatross* Expedition on Sablayan River, southern Mindoro. It has 5 whorls, and measures: Height, 14.9 mm; greater diameter, 32.7 mm; lesser diameter, 25.1 mm.

Remarks.—Ten topotypes, U.S.N.M. No. 296929, yield the following measurements:

	Number of whorls	Height	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
	5. 1	12. 7	31. 1	24. 9
	5. 0	12. 2	30. 6	24. 8
	5. 0	13. 1	30. 3	23. 9
	5. 0	13. 1	33. 8	26. 0
	5. 0	13. 4	32. 4	25. 6
	5. 2	13. 0	32. 2	25. 8
	4. 9	13. 7	32. 3	25. 3
	5. 2	14. 4	30. 6	24. 4
	5. 0	13. 0	30. 9	23. 7
	5. 0	13. 4	32. 8	26. 0
Average	5. 04	13. 2	31. 7	25. 04
Greatest	5. 2	14. 4	33. 8	26. 0
Least	4. 9	12. 2	30. 3	23. 7

This subspecies belongs to the strongly crisscross sculptured group of *Obba mesai*, which character it shares with *O. m. richi*, but in *richi* the crisscross sculpture is obsolete on the base, while in the present subspecies it is strongly developed there.

OBBA MESAI RICHI, new subspecies

PLATE 91, FIGURE 1

The ground color of the early whorls is flesh-color, while that of the later turns is buff. The interrupted bands of brown and mottlings are chestnut-brown. The peristome is soiled white. The spiral striations are quite obsolete on the upper surface of the last half of the last turn, but quite strongly developed on the base.

Type.—The type, U.S.N.M. No. 382698, has 4.9 whorls, and measures: Height, 13.2 mm; greater diameter, 29 mm; lesser diameter, 22 mm.

In the collection of the United States National Museum are two lots of two each of shells of a race of *Obba mesai* about whose definite locality I am in doubt. One of these, U.S.N.M. No. 21043, two specimens collected by the United States Exploring Expedition, bears the label "P. I." The other, U.S.N.M. No. 103967, collected by Rich, bears the label "Luzon, Philippines." One of these is now reentered as U.S.N.M. No. 382698, the type.

Remarks.—The exploring expedition sent out a party from Manila to Laguna de Bay, where it divided, one part visiting the region about Los Baños, including Mount Maquiling, the other pushing toward Banahao, reaching at least Majayjay and Pagsanjan River. Rich, Dana, and Brackenridge were in the Los Baños party.

Since I have seen no specimens from Luzon that appear to belong to the *Obba mesai* complex, I doubt if these were obtained here. The general distribution of the species makes it much more likely that these shells were obtained at the south end of Mindoro, which was also visited by the expedition, and we assume that this was the case.

The topotype, U.S.N.M. No. 103967, has 5 whorls, and measures: Height, 13.8 mm; greater diameter, 28.2 mm; lesser diameter, 22.2 mm. The adult specimen marked "Exploring Expedition collection," U.S.N.M. No. 21043, has 5 whorls, and measures: Height, 15.3 mm; greater diameter, 30.2 mm; lesser diameter, 23 mm.

The present subspecies has the strong crisscross sculpture of *Obba mesai sablayana* on the upper surface of the last half of the last turn. It is distinguished from it by practically lacking this element on the basal surface.

OBBA MESAI MESAI, new subspecies

PLATE 91, FIGURE 2

The typical race when alive is of pale buff ground color on the early turns, deepening on the later and base. In dead specimens the ground color is flesh-color. The dark interrupted bands and mottlings are dark chestnut-brown, the peristome being buffish flesh-colored. The crisscross markings are very fine, almost obsolete, showing best immediately behind the peristome on the upper surface. The spiral striations are conspicuous—more so on the basal portion of the last turn than on its upper surface.

Type.—The type, U.S.N.M. No. 382694, has 5.1 whorls, and measures: Height, 13.3 mm; greater diameter, 29.7 mm; lesser diameter, 22.9 mm. It was collected by Pedro de Mesa on Lubang Island.

Remarks.—Twenty-five topotypes, U.S.N.M. No. 382695, yield the following additional measurements:

	Number of whorls	Height	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
	5.0	14.8	30.2	22.9
	4.9	16.6	30.8	23.3
	5.0	14.4	29.7	23.7
	5.1	12.8	26.6	19.1
	5.1	15.9	32.6	19.3
	5.1	14.4	29.0	23.0
	5.0	12.4	27.6	16.2
	5.1	13.6	29.0	16.3
	5.1	12.8	28.8	22.3
	5.0	12.6	30.9	22.5
	5.0	13.9	27.6	21.0
	5.2	12.1	28.4	22.0
	5.0	14.4	33.1	25.4
	5.0	14.2	29.0	22.8
	5.0	14.3	30.8	22.7
	4.9	13.6	28.8	22.5
	5.0	13.4	28.6	22.5
	5.0	16.8	31.7	24.5
	5.1	14.3	29.4	22.6
	4.9	13.5	30.3	23.6
	5.0	13.4	28.3	22.0
	5.0	13.4	29.0	22.4
	5.0	14.7	30.8	23.4
	5.0	13.5	29.9	22.8
	5.1	15.9	33.0	24.8
Average	5.02	14.07	29.76	22.14
Greatest	5.2	16.8	33.1	25.4
Least	4.9	12.1	26.6	16.2

This subspecies is distinguished from the other three here recognized by its feeble crisscross sculpture, which it has in common with *Obba mesai johnsoni*. From *O. m. johnsoni* it is easily distinguished by its much stronger basal spiral sculpture.

OBBA MESAI JOHNSONI, new subspecies

Plate 92, Figure 4

The ground color is flesh-color with a buffish tinge. The interrupted brown bands and mottlings are bright chestnut-colored, being a little paler on the early than on the later turns. The peristome is flesh-colored with a buffish tinge. The crisscross markings are almost obsolete, being apparent only on the upper surface behind the peristome. The spiral sculpture is poorly developed on both upper and lower surface, but is a little stronger on the lower than the upper.

Type.—The type, U.S.N.M. No. 382699, comes from Ilin Island, south of Mindoro. It has 5 whorls, and measures: Height, 13 mm; greater diameter, 29.2 mm; lesser diameter, 22.5 mm.

Remarks.—This subspecies, like *Obba mesai mesai*, has the crisscross sculpture poorly developed. It is distinguished from *O. m. mesai* by having the spiral sculpture much less strongly developed.

I take pleasure in naming this for Rear Admiral Marbury Johnson, who was in command of the *Albatross* during the first half of her cruise in Philippine waters.

OBBA MARMORATA ILINENSIS Bartsch

Plate 90, Figure 4

1932. *Obba marmorata ilinensis* Bartsch, U. S. Nat. Mus. Bull. 100, vol. 6, pt. 7, p. 341, pl. 86, fig. 3.

This is the smallest race of this species. Its distribution is rather interesting, and it is quite possible that careful collecting in Mindoro will show races of it eventually. It is a pale race, the shell being rather broadly conic. The periphery of the last whorl is rather rounded than angulated, but an obsolete indication of angulation is present. The incremental lines on the upper and lower surface are not so rough as in the other races, and the wrinkling of both surfaces resembles scratches more than the strong wrinkles of some of its other subspecies. The aperture is oval, moderately broad, and the peristome is strongly expanded and reflected on the outer and basal lips. The umbilicus is narrow and half covered by the reflection of the inner lip.

The unique type, U.S.N.M. No. 313001, was donated by Walter F. Webb. It comes from Ilin Island, which lies a short distance off the south coast of Mindoro. It has 4.8 whorls, and measures: Height, 13 mm; greater diameter, 14.2 mm; lesser diameter, 19 mm.

OBBA PLANULATA (Lamarck)

Plate 92, Figures 1, 5

Obba planulata (Lamarck) was described in part 2, volume 6, page 73, of the "Histoire Naturelle des Animaux sans Vertebres," in 1822. No locality is cited as a habitat. In 1838, Deshayes, in his edition of the same work, cites Férussac's "Prodrome," page 69, and Férussac's "Histoire Naturelle des Mollusques," where on pages 48 and 49 he discusses *Helix planulata* Lamarck and where he gives three figures of it on Plate 73A, Figure 3. He cites here Philippine Islands as its home.

These figures represent the giant form. A facsimile specimen is represented in our Lea collection as U.S.N.M. No. 105990. I am copying Férussac's figures (pl. 92, fig. 1) and giving also similar photographs of our shell (pl. 92, fig. 5), which, unfortunately, is also without definite locality. The shell figured on Plate 9 and described by Swainson in his "Zoological Illustrations" in 1820 as *Helix auriculata* appears to belong to the typical race and was most likely received from the same source from which Lamarck obtained his specimen. Swainson states that he received it from Ch. Dubois, Esq.

I am unable to say anything about the position of *Helix papilionacea* Valenciennes, as I have not access to the work in which it is published, but follow Pfeiffer in placing it here.

Mindoro presents an interesting field for the study of zoogeographic races of *Obba*. In the case of the present species we have no less than six races represented in the material before us. One of these is from the central north coast, *Obba planulata varaderoana;* the second, *O. p. paluana*, from the Paluan Bay region. This seems to extend across the northwestern peninsula to Abra de Ilog, at least so a poorly preserved specimen in our collection from that locality would indicate. The third, *O. p. bongabona*, comes from Bongabon on the east coast. The fourth, *O. p. mansalayana*, comes from the Mansalay Bay region. The fifth, *O. p. mangarina*, comes from the southern end at Mangarin, and the sixth, *O. p. cagurayana*, comes from near-by Caguray.

In addition to these races on the island of Mindoro proper, we have material also from some of the small islands adjacent to Mindoro. One, *O. p. medioensis*, I collected on Medio Island, a small isle in Galera Bay off northeastern Mindoro. Another race, *O. p. verdensis*, comes from Verde Island north off Varadero Bay, Mindoro. A third, *O. p. salcedoi*, comes from Ilin Island off southern Mindoro, and a fourth, *O. p. lubangensis*, I collected on Gunting Mountain near Looc, Lubang Island.

KEY TO THE SUBSPECIES OF OBBA PLANULATA IN THE MINDORO PROVINCE

- Last whorl malleated.
  - Malleations on upper surface extending to the peristome.
    - Malleation exceedingly rough .... **lubangensis.**
    - Malleation not exceedingly rough.
      - Greater diameter more than 30 mm .... **varaderoana.**
      - Greater diameter less than 28 mm .... **salcedoi.**
  - Malleations on upper surface not extending to the peristome.
    - Periphery of last whorl acutely angulated .... **bongabona.**
    - Periphery of last whorl not acutely angulated .... **paluana.**

Last whorl not malleated.
  Spiral sculpture on the upper surface of last whorl strong.
    Interrupted spiral brown band conspicuous on base---- **mansalayana.**
    Interrupted spiral brown band not conspicuous on base.
      Shell depressed-helicoid---------------------------- **medioensis.**
      Shell not depressed-helicoid.
        Shell conic---------------------------------- **mangarina.**
  Spiral sculpture on upper surface of last whorl not strong, but feeble.
    Shell depressed-helicoid---------------------------------- **verdensis.**
    Shell not depressed-helicoid.
      Shell conic-- **cagurayana.**

OBBA PLANULATA LUBANGENSIS, new subspecies

PLATE 91, FIGURE 5

The shell is depressed-helicoid. The nuclear whorls are flesh-color, which is also the ground color of the postnuclear turns, but these are spotted, streaked, and vermiculated with brown, there being a concentration of these markings midway between the summit and the periphery to form an interrupted spiral band. A second band of this type is present on the base about one-third of the distance between the periphery and the umbilicus. The base is also finely spotted with brown markings. The nuclear whorls are about 1.4, and are marked by fine incremental lines. The first one and one-half postnuclear whorls are a little more finely sculptured than the succeeding turns, which are decidedly rough and strongly malleated from the summit to the suture, the malleations extending to the peristome on the last turn. The under surface also is malleated and rough. The aperture is oval; the peristome is strongly thickened, reflected, and covers about one-third of the umbilicus at the parietal wall. There is a broad, median tooth on the inside of the basal lip.

Type.—The type, U.S.N.M. No. 382702, was collected by myself on the top of Gunting Mountain, Lubang Island. It has 5 whorls, and measures: Height, 14.1 mm; greater diameter, 30.2 mm; lesser diameter, 23.5 mm.

Remarks.—Seven topotypes, U.S.N.M. No. 256527, furnish the following additional measurements:

Number of whorls	Height	Greater diameter	Lesser diameter
	Mm	*Mm*	*Mm*
5.1	15. 7	32. 3	25. 3
5.3	15. 6	31. 2	24. 9
5.2	14. 4	29. 6	23. 9
5.1	14. 0	29. 9	23. 9
5.2	14. 2	30. 6	23. 9
5.1	14. 8	30. 2	23. 0
5.0	14. 5	32. 3	24. 6

The present species is most nearly related to *Obba planulata varaderoana*, from which it differs by its much rougher sculpture and its somewhat smaller size.

OBBA PLANULATA VARADEROANA, new subspecies

PLATE 92, FIGURE 4

The shell is large, depressed-helicoid, almost lenticular, with a conspicuous carina at the periphery. There is an indication of a median color band consisting of a series of spots, which disappear upon the last half turn. The rest of the upper surface is blotched and spotted and streaked with brown; the pattern is best understood by consulting our figure of the upper surface of the shell. The last third of a turn is darker than the rest and the colored elements more fused. The base is soiled flesh-color, with the outer third vermiculated with pale brown, the inner border of which terminates in a more or less conspicuous band. The peristome is buff with a dusky wash. The postnuclear whorls are malleated on the anterior half, the malleations extending to the peristome on the last whorl on both the upper and lower surface. The whorls are also marked by incised spiral lines, which are stronger on the early postnuclear whorls and the base than on the upper surface of the last whorl. The incremental lines are rather coarse. The aperture is large and rather broad; the peristome is thickened and reflected, and almost half covers the umbilicus. The tooth on the inner lip is strong.

Type.—The type, U.S.N.M. No. 382703, and eight adult specimens, U.S.N.M. No. 256424, were collected by me at Varadero, northeastern Mindoro. The type has 5 whorls, and measures: Height, 15.2 mm; greater diameter, 33 mm; lesser diameter, 27.6 mm.

Remarks.—The nine specimens yield the following comparative measurements:

	Number of whorls	Height	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
	[1] 5.0	[1] 15.2	[1] 33.0	[1] 27.6
	5.1	14.5	31.1	25.9
	5.3	15.3	33.9	26.7
	5.1	14.2	32.0	25.8
	5.1	15.6	32.5	25.5
	5.2	15.6	31.4	25.0
	5.2	15.1	30.6	25.5
	5.3	14.8	30.8	24.4
	5.3	16.3	30.7	24.8
Average	5.177	15.177	31.77	25.69
Greatest	5.3	16.3	33.9	27.6
Least	5.0	14.2	30.6	24.4

---

[1] Type.

The present species belongs to the group which has the malleations on the last whorl extending to the peristome. The only other known member with this character in the general region is *Obba planulata salcedoi,* a much smaller race from Ilin Island.

OBBA PLANULATA SALCEDOI, new subspecies

Plate 92, Figure 3

The shell is lenticular, the last whorl rather acutely angulated at the periphery. The nuclear whorls and the ground color of the postnuclear whorls are flesh-colored. The postnuclear whorls are marked by streaks and blotches of pale brown, and the median spiral band of brown, which extends almost to the peristome. The base is of flesh-colored ground color; the posterior half has the pits of the malleations brown; the peristome is soiled buff and the interior of the outer lip pale brown. The nuclear whorls are marked by fine incremental lines and microscopic spiral striations. The early postnuclear whorls are acutely angulated, the succeeding turns falling below the angle. The first and second postnuclear whorls are malleated on the anterior half; the last one is strongly malleated almost over its entire surface, only the portion immediately below the summit being free of these strong hammer marks. The base is moderately rounded and also malleated on its posterior half. In addition to the malleations, the postnuclear whorls are marked by not strong but irregular incremental lines and very fine spiral striations, likewise fine crisscross lines, which cut the incremental lines and spiral sculpture obliquely. These crisscross lines are strongly marked on the upper surface of the last whorl. The aperture is rather small, broadly oval; the peristome is reflected and thickened and covers about one-third of the umbilicus.

Type.—The type, U.S.N.M. No. 382891, comes from Ilin Island, south of Mindoro. It has 4.5 whorls, and measures: Height, 11.8 mm; greater diameter, 27.3 mm; lesser diameter, 23 mm.

Remarks.—The large extent of the malleations distinguishes this subspecies from all the others.

OBBA PLANULATA BONGABONA, new subspecies

Plate 92, Figure 2

The shell is almost lenticular, the whorls being decidedly keeled; the succeeding ones falling below this keel to which they are appressed gives them a somewhat overhanging aspect. The last whorl is acutely keeled at the beginning, and quite strongly angulated behind the peristome. The first nuclear whorl is flesh-colored, the rest buff. The postnuclear whorls are flesh-colored, blotched, streaked, and vermiculated with brown on the upper surface. A narrow median, more or less interrupted brown band, is present, but evanesces on the last half of the last whorl. The base is flesh-colored with an interrupted brown band one-third of the way between the summit and the suture anterior to the summit. The peristome is flesh-colored, while the inside of the outer lip is a purplish brown. The nuclear whorls have the usual fine incremental lines and spiral striations. The postnuclear whorls are strongly malleated on the anterior two-thirds of the turns on all but the last third of the last whorl. The postnuclear whorls are also marked on the upper surface by rather rough incremental lines and moderately strong incised spiral striations, those on the basal portion being a little more pronounced than those on the spire. Aperture broadly oval; peristome thickened and reflected, covering half of the umbilicus at the parietal wall. There is a strong tooth on the median portion of the inner lip.

Type.—The type, U.S.N.M. No. 382708, comes from the Quadras collection and was collected at Sitio Panlanau, Bongabon, Mindoro. It has 4.6 whorls, and measures: Height, 13.6 mm; greater diameter, 30.6 mm; lesser diameter, 24.4 mm.

Remarks.—Three additional specimens, U.S.N.M. No. 239845, were collected by Mr. Schultze at Bongabon. These yield the following data:

Number of whorls	Height	Greater diameter	Lesser diameter
	Mm	*Mm*	*Mm*
4.6	26. 2	33. 3	14. 0
4.5	12. 4	31. 0	24. 2
4.5	13. 1	30. 3	25. 0

This subspecies in the character of malleations resembles *Obba planulata paluana*, from which it is at once distinguished by its much larger size and flatter form and less strong spiral sculpture. In its flat shape and angulated periphery of the early whorls it suggests *O. p. varaderoana*, from which its smaller size and less conspicuous spiral sculpture, as well as the less malleated base, distinguish it.

OBBA PLANULATA PALUANA, new subspecies

Plate 93, Figure 1

The shell is depressed-helicoid with the periphery of the last whorl well rounded. The first nuclear whorl is flesh-colored, the succeeding turns pale brown. The postnuclear whorls are of flesh-colored ground color, spotted, streaked, and vermiculated with bright chestnut-brown. The last whorl is a little paler than the rest. A narrow median brown band encircles all the postnuclear whorls except the last fourth of the last turn. The base is flesh-colored, the vermiculations extending to the faint brown spiral line, which is at about one-third of the distance between the periphery and the umbilicus, anterior to the periphery. The peristome is flesh-colored; the interior of the outer lip is brown. The first postnuclear whorl is marked by fine incremental lines and fine spiral striations; the succeeding ones, except the last half of the last turn, are strongly malleated on the anterior half and marked by feeble incremental lines and rather strong spiral striations on the upper surface, as well as on the base of the last whorl where the spiral striations are even stronger. On the first half of the last whorl of the base there are moderately strong malleations between the brown band and the periphery, the depressed portions being brown. The aperture is broadly oval; the peristome reflected, expanded, and thickened, covering about half of the umbilicus. The inner lip bears a conspicuous fold on its middle.

Type.—The type, U.S.N.M. No. 382888, is one of a series of specimens collected by Pedro de Mesa at Paluan, Mindoro. It has 4.9 whorls, and measures: Height, 13.1 mm; greater diameter, 27.9 mm; lesser diameter, 22.3 mm.

Remarks.—Ten additional specimens, U.S.N.M. No. 382889, from the same source yield the following information:

	Number of whorls	Height	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
	4.9	[1] 13. 1	[1] 27. 9	[1] 22. 3
	4.8	13. 2	27. 6	21. 7
	5.2	14. 5	27. 0	21. 6
	5.2	13. 3	28. 6	21. 9
	5.1	13. 1	26. 8	21. 0
	5.0	12. 1	24. 0	19. 9
	5.2	13. 8	25. 9	20. 8
	5.2	14. 3	29. 4	22. 9
	5.4	14. 2	26. 7	21. 8
	4.9	13. 5	25. 8	20. 2
	5.3	13. 0	26. 4	20. 9

[1] Type.

Two, U.S.N.M. No. 256408, collected by the United States Bureau of Fisheries *Albatross* Expedition, yield the following measurements:

	5.3	14. 0	28. 6	22. 4
	5.0	13. 7	27. 8	22. 4

U.S.N.M. No. 382890 contains a specimen collected by Pedro de Mesa at Tara, Abra de Ilog, Mindoro, which measures:

	5.0	13.2	26.3	20.8
Average	5. 107	13. 5	27. 06	21. 47
Greatest	5. 4	14. 5	29. 4	22. 4
Least	4. 8	12. 1	24. 0	19. 9

This species recalls *Obba planulata bongabona* as far as the general sculptural pattern is concerned, but the whorls are more rounded, and there is not the peripheral overhang that is present in *O. p. bongabona*, the last whorl being rounded rather than angulated.

OBBA PLANULATA MANSALAYANA, new subspecies

PLATE 93, FIGURE 2

The shell is moderately elevated with obsoletely angulated periphery. Nuclear whorls pale brown. The first postnuclear whorl is almost brown marked by a few axial streaks of pale buff, which is the ground color of the succeeding turns upon which also chestnut-colored blotches occupy a larger area than the ground color. On all the postnuclear whorls but the last one and a quarter an interrupted median chestnut-colored band is present. The base is pale buff with a broad interrupted spiral band of brown, which is about one-fourth of the distance between the periphery and umbilicus anterior to the periphery. The peristome is white, while the interior of the outer lip is brown with a purplish flush. The early postnuclear whorls are feebly malleated on their anterior half; these malleations disappear

	Number of whorls	Height	Greater diameter	Lesser diameter
		Mm.	*Mm.*	*Mm.*
	[1] 5. 2	[1] 14. 3	[1] 27. 4	[1] 21. 6
	5. 3	13. 4	28. 0	21. 8
	5. 4	12. 3	29. 2	22. 2
	5. 5	13. 6	28. 6	22. 4
	5. 2	13. 5	29. 5	23. 2
	5. 2	11. 5	25. 8	20. 7
	5. 4	13. 3	28. 5	22. 1
	5. 4	14. 4	27. 2	21. 2
	5. 3	13. 9	25. 9	21. 0
	5. 2	12. 0	28. 9	23. 3
	5. 5	13. 5	27. 5	22. 0
	5. 3	13. 0	29. 3	25. 0
	5. 4	11. 5	27. 0	21. 1
	5. 2	12. 1	26. 6	21. 1
	5. 4	13. 6	27. 4	21. 6
	5. 4	13. 6	29. 6	22. 7
	5. 1	13. 6	29. 1	22. 8
	5. 3	12. 5	28. 4	21. 6
	5. 2	13. 0	29. 0	22. 2
	5. 3	13. 9	30. 6	23. 3
	5. 4	14. 2	30. 2	22. 6
	5. 4	14. 8	28. 2	22. 5
	5. 3	14. 4	27. 6	22. 0
	5. 2	14. 0	30. 2	22. 8
	5. 5	14. 4	28. 2	22. 0
Average	5. 32	13. 372	28. 316	22. 192
Greatest	5. 5	14. 8	30. 6	25. 0
Least	5. 1	11. 5	25. 8	20. 7

---

[1] Type.

before the last whorl and a half are reached. The incremental lines are not strong, but the incised spiral lines are well developed and very regular both on the spire and base. The aperture is oval; the peristome, thickened and reflected, covers about half of the umbilicus at the parietal wall.

Type.—The type, U.S.N.M. No. 382705, and a lot of additional specimens, U.S.N.M. No. 256436, were collected by the writer on a hill on the west shore of Mansalay Bay, Mindoro. The type has 5.2 whorls, and measures: Height, 14.3 mm; greater diameter, 27.4 mm; lesser diameter, 21.6 mm.

Remarks.—Twenty-five specimens yield the data given in the table on page 367.

This subspecies, while it resembles *Obba planulata medioensis*, is easily distinguished from this by its smoother surface and the very conspicuous interrupted basal band.

OBBA PLANULATA MEDIOENSIS, new subspecies

Plate 93, Figure 3

The shell is depressed-helicoid with the periphery of the last whorl obsoletely angulated. The nuclear whorls are dark buff; the whorl that succeeds them is brown, while the rest of the upper surface is of flesh-colored ground color, blotched, spotted, and vermiculated with dull chestnut-brown. On all the postnuclear whorls a somewhat darker interrupted zone marks the obsolete peripheral angle. The base is soiled flesh-color with a moderately broad, interrupted, ill-defined, dark band about one-third of the distance between the periphery and umbilicus anterior to the periphery. The space between this band and the periphery is indistinctly marked with a few streaks of brown. The peristome is flesh-colored with a brownish flush, while the inside of the outer lip is pale brown with a purplish wash. The postnuclear whorls are weakly malleated on the anterior half, except the last turn where this character fades out. The postnuclear whorls are also marked by rather coarse and irregular incremental lines and strongly incised wavy spiral lines, which are present on both spire and base. Aperture moderately large, oval; peristome reflected over about one-third of the umbilicus. Tooth on the inner lip strongly developed.

Type.—The type, U.S.N.M. No. 382704, and a lot of additional specimens, U.S.N.M. No. 256438, were collected by myself on Medio Island in Galera Bay, off northeast Mindoro. The type has 5.2 whorls, and measures: Height, 13.8 mm; greater diameter, 28.4 mm; lesser diameter, 22.6 mm.

Remarks.—Twenty-five specimens yield the following data:

	Number of whorls	Height	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
	5.2	13.4	28.2	22.0
	5.1	14.9	29.2	23.0
	5.4	14.7	28.4	22.9
	5.3	13.7	28.7	22.6
	5.2	13.3	26.9	21.6
	5.4	15.1	29.6	23.3
	5.2	13.5	28.6	23.4
	5.3	14.2	28.9	22.8
	5.0	13.0	28.0	22.7
	5.1	13.0	27.8	22.5
	5.2	14.1	28.9	22.6
	5.5	14.2	28.6	23.0
	5.2	13.7	29.0	23.1
	5.2	13.5	29.3	23.4
	5.2	13.0	28.1	22.0
	5.1	12.7	29.0	22.9
	[1] 5.2	[1] 13.8	[1] 28.4	[1] 22.6
	5.3	13.2	29.2	23.2
	5.2	15.5	28.7	22.9
	5.2	13.2	28.4	22.6
	5.2	13.9	28.9	23.4
	5.1	13.3	28.8	23.5
	5.5	14.8	29.3	23.9
	5.3	14.0	29.7	23.8
	5.3	12.8	28.3	22.9
Average	5.236	13.78	28.676	22.9
Greatest	5.5	15.5	29.7	23.9
Least	5.0	12.7	26.9	21.6

[1] Type.

The present subspecies resembles most nearly *Obba planulata mansalayana*, but can at once be distinguished from it by the practical absence of the basal spiral zone.

OBBA PLANULATA MANGARINA, new subspecies

PLATE 93, FIGURE 4

The shell is broadly conic and its last whorl obtusely angulated. The first nuclear whorl is flesh-colored, the next straw-colored; the first postnuclear whorl is bright chestnut-brown, the rest are of flesh-colored ground color, spotted and vermiculated with brown. In fact the chestnut-brown coloration is so strong that it overshadows the lighter flesh-colored elements and might well be considered the major color scheme. A narrow median brown band, a little deeper than the rest of the brown coloration of the upper surface, marks the middle of the postnuclear whorl, except the last fourth of the last turn. The base is flesh-colored, spotted and mottled with brown; the peristome is white, while the interior of the outer lip is purplish brown. The anterior two-thirds of the postnuclear turns are strongly malleated. These malleations evanesce at about the termination of the next to the last whorl. The postnuclear whorls are marked by rather rough and somewhat irregular incremental lines and moderately strong, well-incised, spiral striations. The base of the last whorl is malleated; the impressed portions being brown lend to it a peculiar color pattern. It is also marked by the continuations of the incremental lines and spiral striations, which are a little stronger than those on the upper surface. Aperture ovate; peristome broadly expanded and reflected, half covering the umbilicus at the parietal wall. The inner lip has a conspicuous tooth on its middle.

Type.—The type, U.S.N.M. No. 382709, comes from the Quadras collection and was collected at Sitio, Lalangan, Mangarin, southern Mindoro. It has 4.8 whorls, and measures: Height, 14.9 mm; greater diameter, 28 mm; lesser diameter, 21.5 mm.

Remarks.—This shell in shape and coloring resembles most nearly *Obba planulata cagurayana*, with which it is also geographically most nearly approximated, but it is at once distinguished by its much rougher sculpture both on spire and base.

OBBA PLANULATA VERDENSIS, new subspecies

Plate 93, Figure 6

The shell is depressed-helicoid. The early whorls are of dark buff and the later of flesh-colored ground color. A conspicuous median bright chestnut-brown band, which is almost complete, is present on the upper surface. A second, but a little more interrupted, band is present at the angulated periphery. In addition to these bands, the upper surface of the whorls is marbled and axially streaked with brown. The basal surface is flesh-colored with an interrupted zone of brown about as distant from the periphery as the median band on the upper surface of the whorl is distant from it. The peristome is white. All but the last postnuclear whorls are malleated on the anterior half of the turns. In the same area they are also marked by rather strongly incised spiral lines, but these weaken decidedly on the last whorl. The incremental lines are irregular and rather coarse, even on the lower surface. On the base the incised spiral lines are stronger than on the upper surface. The aperture is large, oval, with the peristome thickened and reflected, covering one-third of the umbilicus at the parietal wall. The median basal tooth of the inner lip is quite strongly developed.

Type.—The type, U.S.N.M. No. 256550, was collected by Col. Edgar A. Mearns on Verde Island off northeast Mindoro. It has 5 whorls, and measures: Height, 12.3 mm; greater diameter, 32.2 mm; lesser diameter, 24.9 mm.

Remarks.—This is a large, flat, bright-colored race, which has a conspicuous interrupted basal color band. The malleations do not extend upon the last turn, on which the spiral striation is not strongly developed

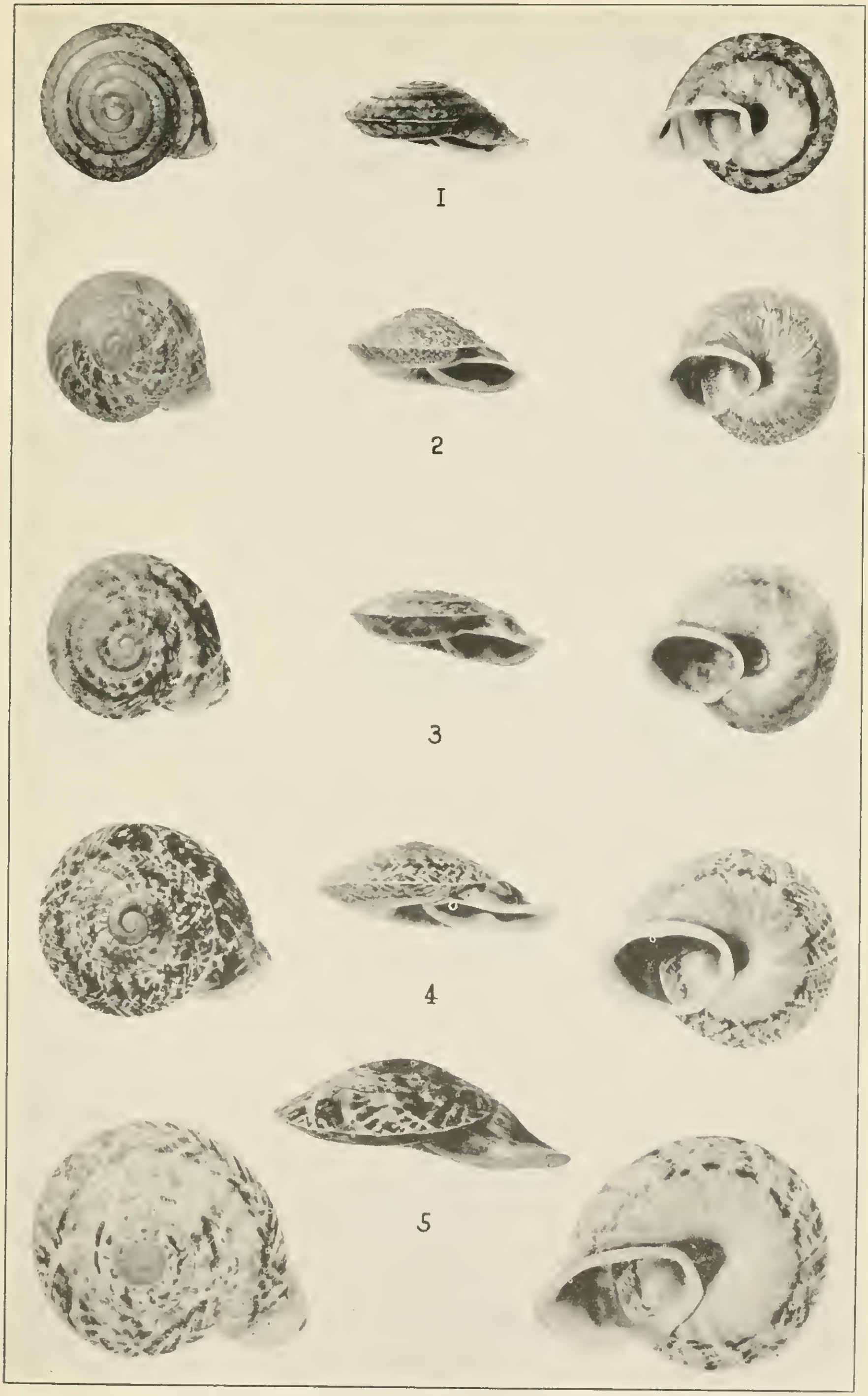
OBBA PLANULATA CAGURAYANA, new subspecies

PLATE 93, FIGURE 5

The shell is broadly conic and weakly angulated at the periphery of the last whorl. The first nuclear whorl is pale buff, the rest deeper buff. The first postnuclear whorl is chestnut-brown, which is also the color of the remaining turns. In addition to this, the whorls are marked by more or less zigzag or interrupted axial lines and dots of flesh-color. There is a narrow median brown band on all the whorls, which extends to the peristome on the last turn. The base is pale brown with a deeper brown band about one-third of the distance between the periphery and the umbilicus anterior to the periphery. The postnuclear whorls in the young shell are strongly keeled, and the succeeding turns drop below this keel to which they are appressed. All but the last one and one-third turns are feebly malleated on the anterior half. The postnuclear whorls are marked by rather regular, weak, retractively curved incremental lines and exceedingly fine spiral striations on the upper surface. On the base of the last whorl these spiral striations become more pronounced. The aperture is broadly oval; the peristome is strongly reflected and thickened, covering half the umbilicus at the parietal wall. The inner lip has a conspicuous tooth on its middle.

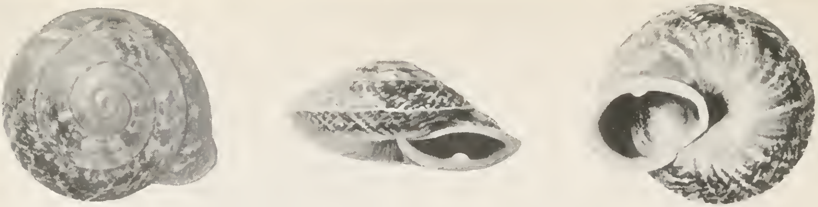
Type.—The type, U.S.N.M. No. 382887, was collected by C. Canonizado at Caguray. It has 5 whorls, and measures: Height, 13.6 mm; greater diameter, 26.9 mm; lesser diameter, 21.3 mm.

Remarks.—This species most nearly resembles *Obba planulata mangarina*, from which it can at once be distinguished by its much smoother sculpture.

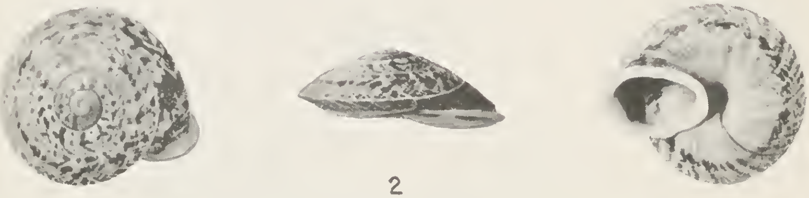


SUBSPECIES OF OBBA GALLINULA AND O. LISTERI

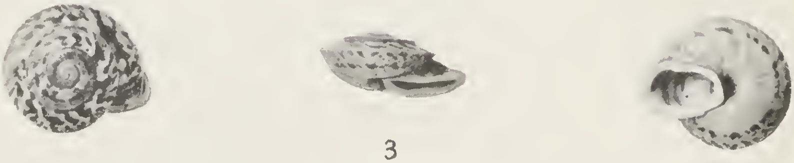
1, *Obba gallinula barthelowi*, new subspecies; 2, *O. listeri sibolonensis*, new subspecies; 3, *O. l. halcona*, new subspecies; 4, *O. l. campoensis*, new subspecies; 5, *O. l. listeri* (Gray). Natural size.



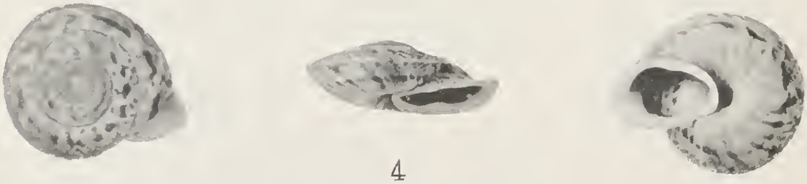
1



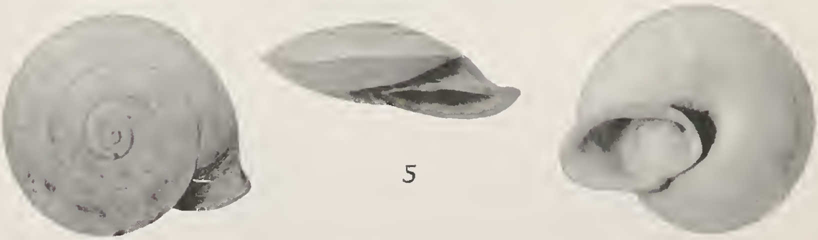
2



3



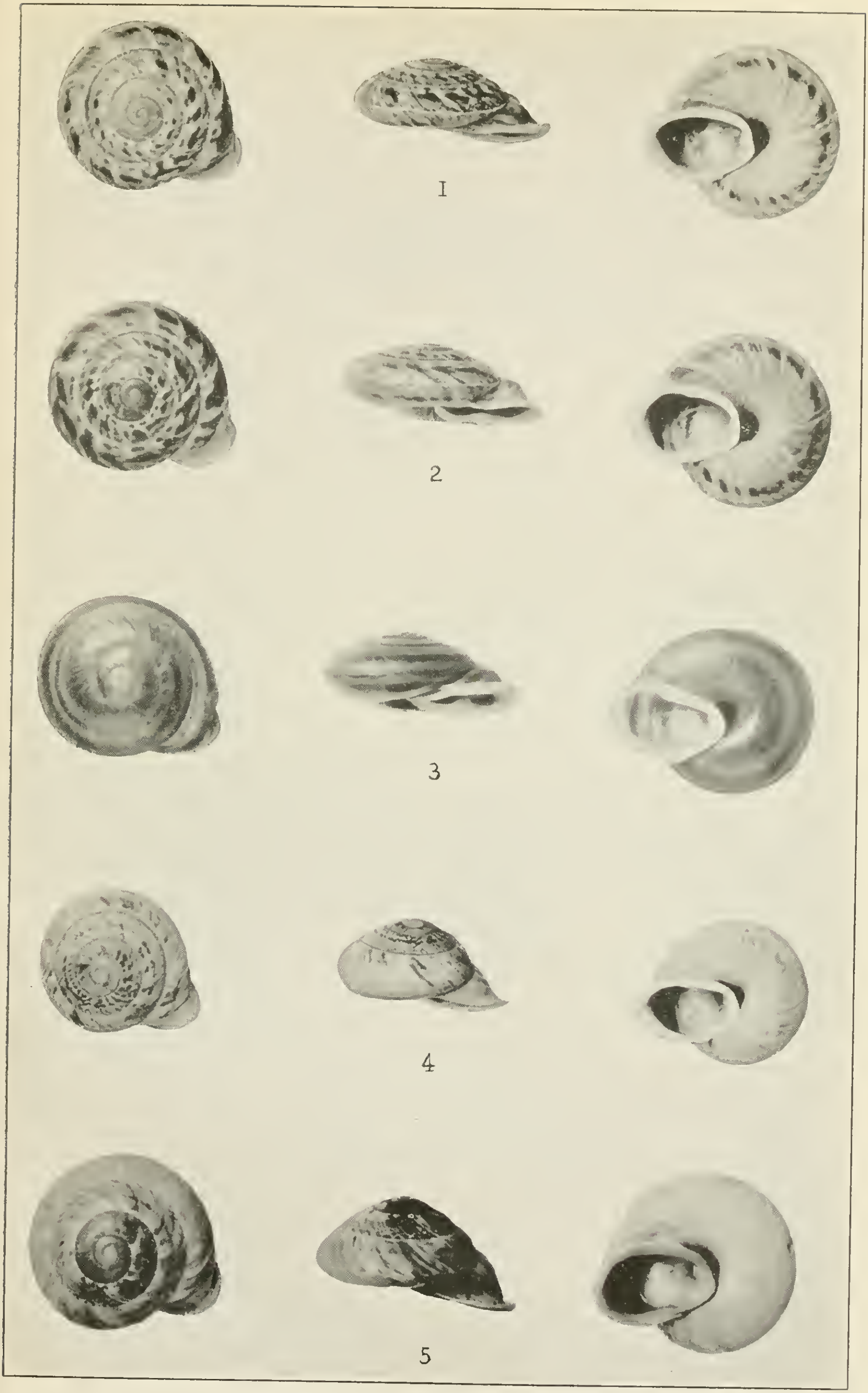
4



5

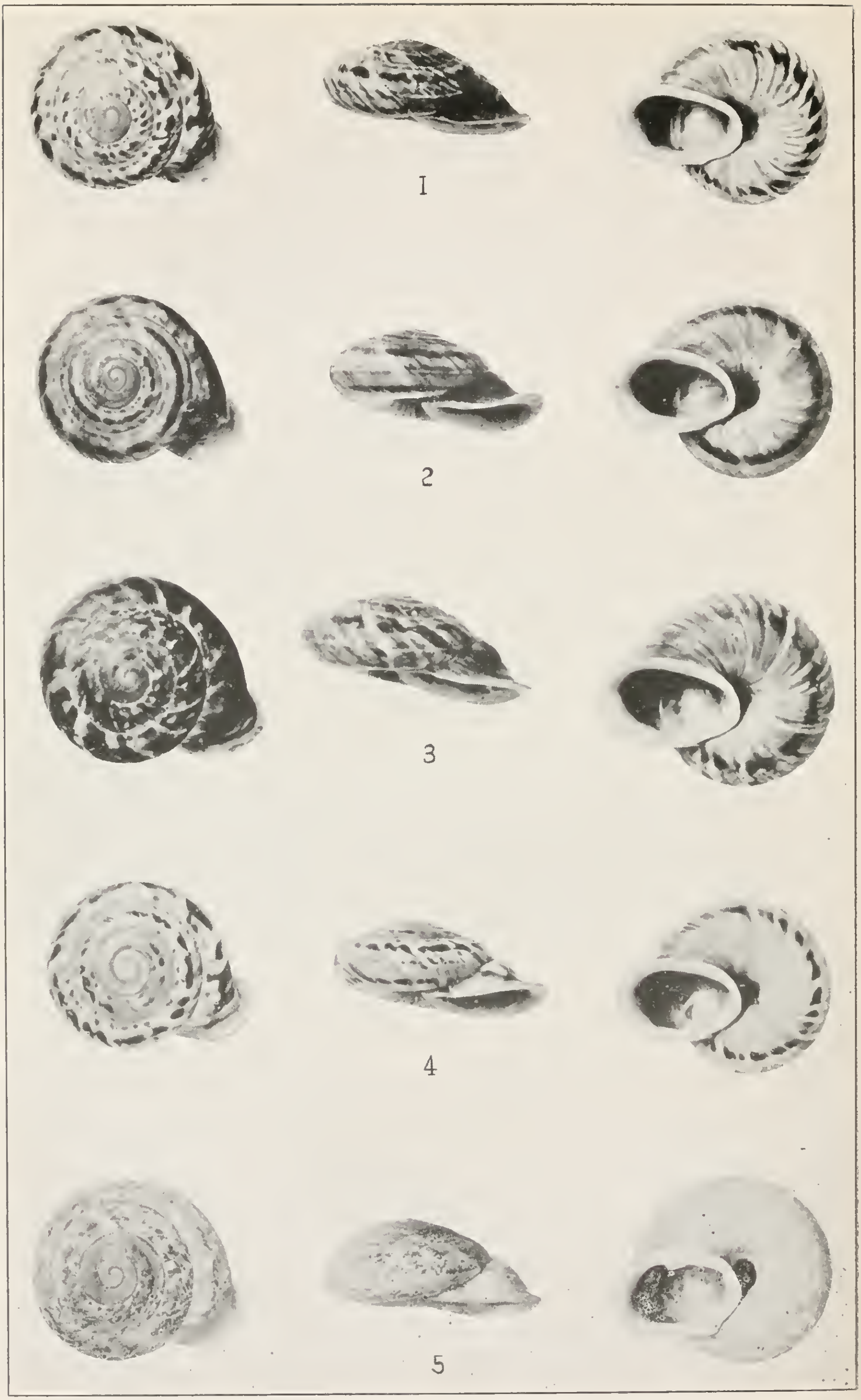
SUBSPECIES OF OBBA LISTERI

1, *Obba listeri mayabigana*, new subspecies; 2, *O. l. minor* (Möllendorff); 3, 4, *O. l. recurvata* (Möllendorff); 5, *O. l. smithi*, new subspecies. Natural size.



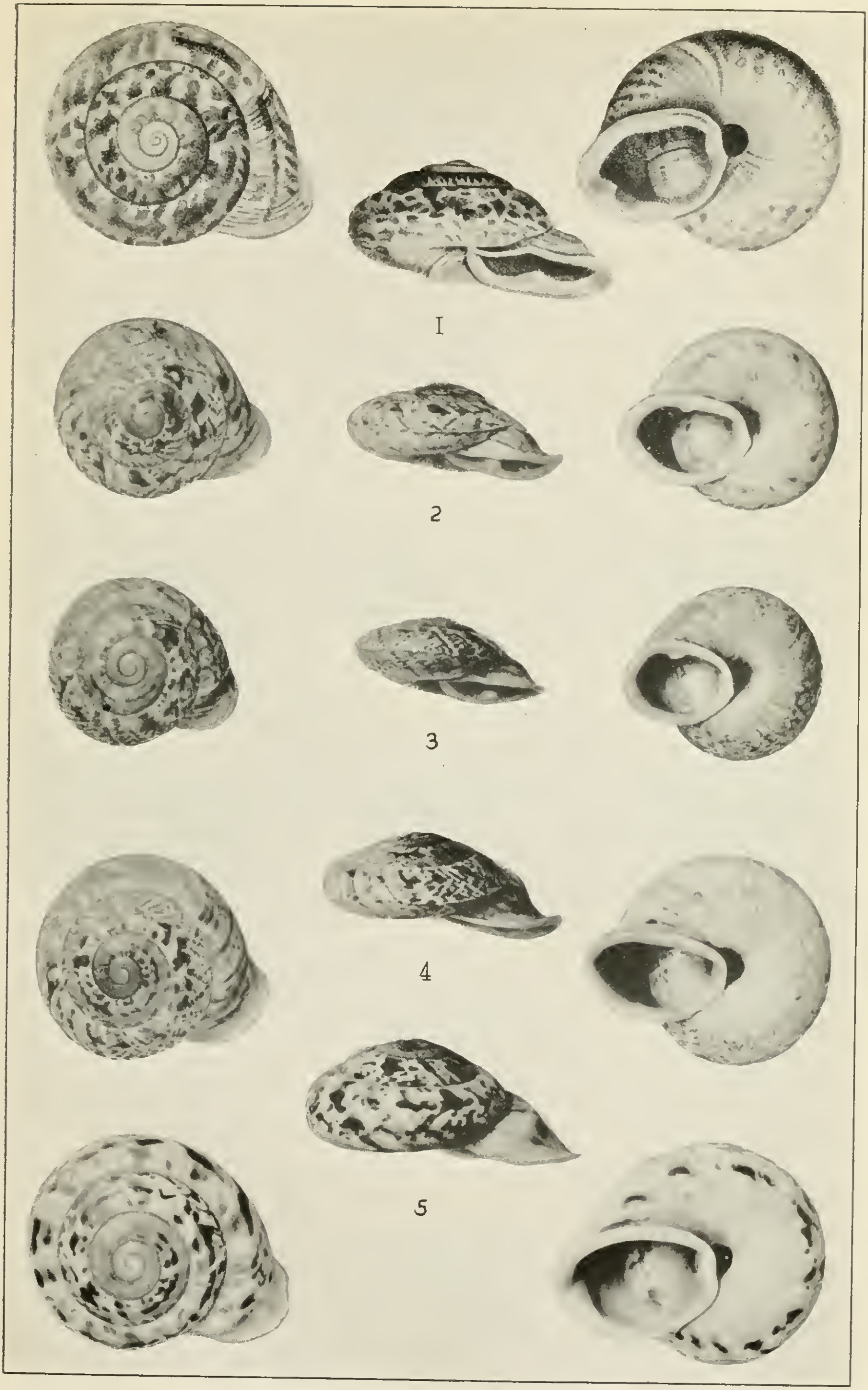
FORMS OF FOUR SPECIES OF OBBA

1, *Obba listeri caloocana* new subspecies; 2, *O. l. subplanulata* (Möllendorff); 3, *O. subhorizontalis radcliffei*, new subspecies; 4, *O. marmorata ilinensis* Bartsch; 5, *O. sarcochroa ilogana*, new subspecies. Natural size.



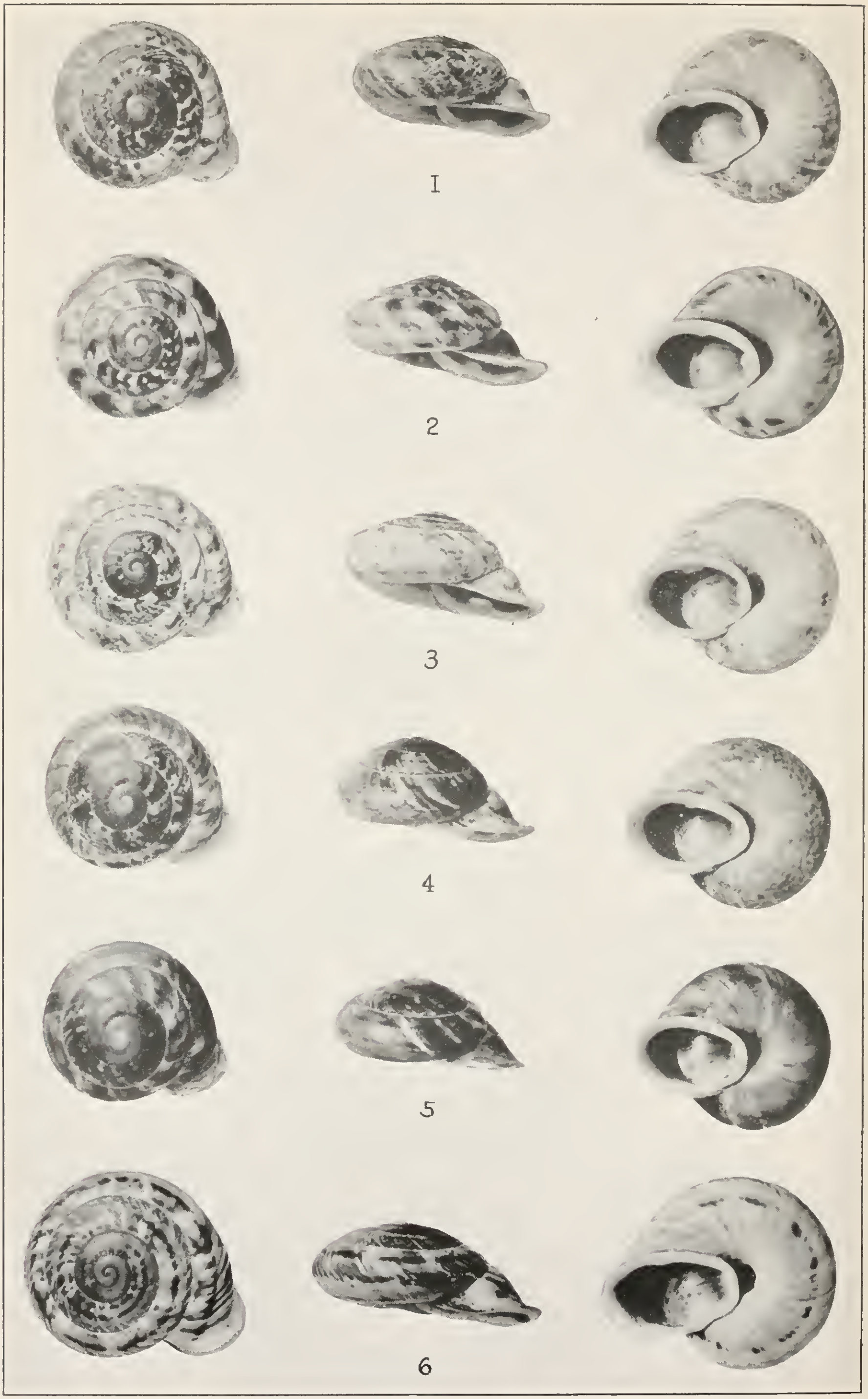
SUBSPECIES OF OBBA MESAI, NEW SPECIES, AND O. PLANULATA

1, *Obba mesai richi*, new subspecies; 2, *O. m. mesai*, new subspecies; 3, *O. m. sablayana*, new subspecies; 4, *O. m. johnsoni*, new subspecies; 5, *O. planulata lubangensis*, new subspecies. Natural size.



SUBSPECIES OF OBBA PLANULATA

1, *Obba planulata planulata* (Lamarck), copy of Férussac's figures; 2, *O. p. bongabona*, new subspecies; 3, *O. p. salcedoi*, new subspecies; 4, *O. p. varaderoana*, new subspecies; 5, *O. p. planulata* (Lamarck). Natural size.



New Subspecies of Obba planulata

1, *Obba planulata paluana;* 2, *O. p. mansalayana;* 3, *O. p. medioensis;* 4, *O. p. mangarina;* 5, *O. p. cagurayana;* 6, *O. p. verdensis.* Natural size.

THE TREE SNAILS OF THE GENUS COCHLOSTYLA OF MINDORO PROVINCE, PHILIPPINE ISLANDS

By Paul Bartsch

INTRODUCTION

In no other area in the entire Philippine Archipelago do we find a greater confusion in our knowledge of its tree-snail fauna than in Mindoro, the main island of this province. Though Mindoro has been contributing specimens since the very early days of contact with civilization, most of them came from the well-known ports on the northeastern part of the island. The reason for this is voiced by Dr. Dean C. Worcester, who states on page 362 of his book "The Philippine Islands", published in 1899:

> Nowhere in the northern Philippines is there an island so little known, or one so universally avoided by white men. The natives frequently refer to it significantly as the "white man's grave." At the present time it is celebrated chiefly for the unsavoury reputation of its people, the heaviness of its rainfall, and the deadliness of the miasma in its fever-smitten lowlands.
>
> There was a time when Mindoro was famous for other things. So much rice was formerly raised along the coast as to cause the island to be named "the granary of the Philippines," and the population of the numerous coast villages seems to have consisted chiefly of peaceable, law-abiding Tagalogs. All this has long since been changed. The prosperity of the civilized natives served to attract the attention of the Moros, who repeatedly raided their towns, rapidly thinning the population. An epidemic attacked the buffaloes, nearly exterminating them, and leaving the natives without means of tilling their land; and cholera did the rest.
>
> To-day the once rich fields have for the most part grown up to forest land, and the island is a rendezvous for desperate criminals, who escape from the neighbouring provinces and seek refuge in Mindoro, well knowing that if they once reach the forest there they are safe from pursuit.
>
> The few poverty-stricken villages on the east coast are supposed to be under Spanish protection and control. How much that protection amounts to I shall attempt to show later. There are villages on the west coast also. White men who value their lives do not often visit them.
>
> In the interior of the island are a number of lofty mountains, the highest peak attaining an altitude of 8,865 feet. These mountains and the adjacent lowlands are clothed in magnificent forest which the hand of man has never disturbed. Under the shadows of its mighty trees dwell a race of primitive savages, the Mangyans. They bear a very bad reputation, which is wholly undeserved.
>
> Between the mountains and the west coast are extensive plains, covered with high grass. East of the mountains are heavily timbered lowlands, crossed by

numerous rivers. The surface details given in the best charts are wholly unreliable, and such large rivers as the Baco are left out altogether.

The rainfall is enormous. There are no statistics available, but it rains heavily during nine months of the year, and not infrequently during the other three, as I have learned to my sorrow. Exploration in the interior can be carried on only at the height of the dry season, in March, April, and May.

There is no anchorage at Calapan, and the surf runs so heavily during October, November, and December that steamers are often forced to carry the mails by.

The only Europeans in the island outside of Calapan are a half-dozen friars, and at the capital there are only the necessary officials, and one or two shopkeepers who are too poor to get away.

On our first trip to the Philippines we purposely put Mindoro last on our list of islands to be visited, knowing that if we were fortunate enough to escape the *tulisanes* we should still get the fever, and wishing to be able to start for home at once should it seriously disable us.

The first serious collecting in Mindoro was done by Hugh Cuming, who was probably the most successful collector of mollusks in his day. His visits to the Philippines extended from 1836 to 1839 and resulted in bringing to light more novelties than all the previously known species. They have been reported on by many writers, and a set is in the collection of the United States National Museum. Since some doubt has been raised about the localities cited by Cuming for some of his species, I quote from an article by W. J. Broderip, published in the Proceedings of the Zoological Society of London for 1840, pages 83–84:

> Before, however, we commence our task, I must, in justice to him who has placed the materials in our hands, observe, that, to say nothing of the variety of new forms which he has been the means of bringing to light, those who cultivate this branch of zoology so highly interesting to the geologist, as well as the physiologist, owe him a large debt of gratitude, for information on a point of no small zoological importance. It is not very long since, that the localities ascribed to shells could in very few instances be depended upon. The cupidity of dealers, some years ago, not unfrequently prompted them wilfully to deceive those who gave extravagant prices for new shells on this point, and carelessness was generally the order of the day. Mr. Cuming, by his accurate notes, and the open publication of the places where every one of the multitudinous species and varieties collected by him was found, has mainly assisted in making a complete revolution in this department of the science, and has done more towards giving us data for the geographical distribution of the testaceous mollusca than any person who has yet lived.

I concur in Broderip's statement.

Hugh Cuming visited Mindoro and collected at Puerto Galera and Mansalay Bay.

W. W. Wood sent "many fine shells . . ." from the Philippine Islands to Isaac Lea, who described a number of species in the Transactions of the American Philosophical Society in 1840. No specific locality is given with any of Wood's shells, but the fact that *Cochlostyla cepoides* is here described shows that he must have been in the mountains of Lubang Island or had a collector there.

On January 24, 1842, a party of the United States Exploring Expedition stopped on the southwest corner of Mindoro and must have secured quite a lot of conspicuous shells, at least so the collections in the United States National Museum would indicate.

Dr. Carl Semper conducted scientific explorations in the Philippines between 1858 and 1864, which have resulted in that splendid series of volumes known as Semper's Reisen im Archipel der Philippinen.

Semper's servant, Antonio Angara, made a trip to northeastern Mindoro, which resulted in the discovery of some members of the genus *Cochlostyla*.

During the Spanish regime and up to the American conquest of the Philippines, J. F. Quadras occupied the position of chief forester of the islands. Quadras was an enthusiastic shell collector, and I was told by members of his family during my sojourn in the islands that he would appoint no one to his staff unless the appointee had similar tendencies. This was undoubtedly responsible for the magnificent collection that he amassed, which was displayed in the Philippine Section during the World's Fair in St. Louis in 1904. This collection was offered for sale in America by his son who failed to find a purchaser. It was stored for some time in the Chicago Academy of Sciences and then returned to Manila, where it now rests in the Philippine Bureau of Science, except for a set acquired by the Chicago Academy of Sciences and by them sold to the United States National Museum.

Quadras' finds were largely described by Dr. O. F. von Möllendorff and Joaquin G. Hidalgo, of Madrid, Spain. Many things from Mindoro Province are in the Quadras collections.

Dr. Otto Franz von Möllendorff, German Consul at Manila from 1886 to 1896, made known to the world the minute mollusks of the Philippines. His efforts added more than 800 species. His splendid collection rests in the Senckenbergische naturforschende Gesellschaft in Frankfurt-am-Main, from which a set of his duplicates has been secured for the United States National Museum, among which most of the old species from Mindoro are represented.

In 1887-8, Dr. J. B. Steere, with Dr. Frank S. Bourns, E. L. Moseley, Dean C. Worcester, and Mateo Francisco, collected natural-history material in the Philippines, Worcester and Bourns spending some time in northeastern Mindoro until forced out by malaria.

Two years later Worcester, Bourns, and Francisco, while on the Menage Expedition, made two trips to Mindoro, collecting from Calapan south to Lake Naujan and west to Mount Halcon. They made a splendid collection of mollusks, securing large series of the larger species represented in the region. This collection, which for a time rested in the Minnesota Academy of Sciences, has been purchased by the United States National Museum and has been available for study.

Students interested in field natural history will find Dr. Worcester's book a fascinating volume.

Dr. Worcester later became a member of the United States Philippine Commission and still later the Secretary of Interior of the Philippine Islands. During all this period, and later as a private citizen up to his death, he maintained an interest in the natural history of the islands and collected material that has been in my hands for report.

Col. Edgar A. Mearns, U. S. Army, made many collections during his periods of service in the Philippine Islands. Among his many expeditions he made one to Mount Halcon, the highest peak in Mindoro. On this expedition many land shells were collected. Among the novelties obtained on that expedition and here described is *Cochlostyla lillianae*, an exquisitely beautiful shell, of which, unfortunately, only the type is known.

To put definitely on record the ground covered by that Mount Halcon Expedition, I shall quote Colonel Mearns' itinerary:

> Left Manila 7:30 p. m. October 30, 1906, on U. S. A. T. *Mindanao.* Party accompanied to Calapan by Horace C. Fletcher. Arrived Calapan daybreak October 31. Left Calapan in two native boats Nov. 1, arriving at Subaan, 9 m. NW. on the coast, at 3 p. m. Left Subaan 9 a. m. Nov. 2, marched 10 m. (5 air line) SW. to Binaybay River, camping on the mining claims of P. T. Bergen and R. E. Burris. Left Bergen Camp 7 a. m. Nov. 5 and marched SW. 1 mile to Mangyan clearing on top of hill, named Buena Vista, elevation 1,200 feet. Proceeded down S. trail to river named the Egbert, distance 1 mile; thence 300 yards down stream to Alag River. Crossed Alag at this point and followed Alag River upstream along east (R.) bank 2 miles to point where the Alag R. forks. Proceeded up east (R.) fork (main Alag R.) naming the west (L.) fork the Lewton R. 1 mile; camped at 4 p. m. (Camp No. 2). Nov. 8, left camp 8 a. m., marched up the Alag 1½ m. to small falls, thence up small stream entering main Alag R. from the west (L. bank) 300 yards, thence up ridge on the south side of stream (R. bank) ¾ m. to Mangyan clearing at 2,500 feet elevation, Camp No. 3 at this point. Small stream ¼ m. down R. slope, to the SW. of camp.
>
> Broke camp 7:30 a. m. Nov. 12, proceeding along trail on S. side of clearing to cogon-covered caingin on crest of ridge, same elevation as Camp No. 3 (2,500 feet); thence down Mangyan trail, south, to Alag River. Distance Camp 3 to Alag, 2 miles. Stream entering Alag R. a few yards above a Mangyan bejuca suspension bridge (7 strands) named the Halcon Bridge. The stream was named the Halcon River. We marched up Halcon R. 50 yards and thence up old Mangyan trail to the right (from left bank of Halcon River), SW., going up parallel to stream; camped at 3:30 p. m. at 3,300 ft. elevation (Camp No. 4). No water found near this camp.
>
> Nov. 3. Broke camp at 6 a. m. Proceeded along ridge trail a short distance, following it down to caingin area east of ridge summit. Three houses in these clearings; one a mere framework, covered; two covered and inhabited. One large house near S. end of clearing, cleverly hidden (photographed). From this house a Mangyan trail leads down to the Bolton R., where we found plenty of water (as also in a small tributary nearer to the Mangyan house) and cooked breakfast. From camp No. 4 to Bolton R. crossing ¾ m. From Bolton R. proceeded SE. up ridge 1 mile to elevation of 4,500 feet. Camp No. 5. Water, small stream 300 yards down slope to the SW.

Left camp No. 5 at 8 a. m. Nov. 17, proceeding along trail on east side of ridge to series of flats at 6,300 feet elevation. Camp No. 6, named "Posey Flats" in honor of "Posey" (E. D.) Merrill, botanist of the party. Camp No. 5 to Posey Flats distance 1 mile.

Nov. 19, Merrill and Hutchinson completed chopping out a trail to main ridge of Halcon and along the main ridge nearly to the Peak, returning to Camp 6 at dark, wet, hungry, and tired. Rained hard until noon.

Nov. 20. Rained nearly all last night. High wind. Rained on.

During the explorations of the United States Fisheries steamer *Albatross* in the Philippines, we touched Mindoro and some of the adjacent islands, where I had an opportunity to make collections of land mollusks and other things.

On June 4, 1898, we anchored in Mansalay Bay, where I made collections on the west shore of the bay and along the river, entering it here; also along the northeast point of the bay.

On June 5 I covered half of the distance between the mouth of the river leading to Lake Naujan and the Lake, collecting at intervals.

June 8 and 9 we spent at Puerto Galera. Here I collected on Paniquian and Medio Islands, as well as on the part of Mindoro that forms the rest of the rim of the bay.

July 14 and 15 were spent collecting on Lubang Island. We visited Vigo Bay, Tilig Bay, Balikias Bay, and Loog Bay. From the latter place a couple of expeditions were made to the summit of Gunting Mountain, which among other things yielded a lot of the peculiar *Cochlostyla cepoides* (Lea).

The most thorough and important mollusk collecting yet done in Mindoro Province is in progress at the present time. Another apparently indefatigable and enthusiastic collector, Pedro de Mesa, is producing so many new and interesting finds that we may well believe that all the past efforts scarcely represent a reconnaissance. His splendid sendings made necessary the critical review here published, which I hope may produce a better understanding of the *Cochlostyla* fauna of the region.

Helicostyla and *Cochlostyla* were proposed by Férussac in the same work [1] as subgenera of *Helix; Helicostyla* was placed in the group Helicoides, and *Cochlostyla* in the Cochloides. For almost 40 years thereafter these two subgenera were considered to belong to different "genera" (groups we now would call families).

Beck [2] recognized these two subgenera, removing from them a number of what he considered unrelated species and adding others. For the first group he retained the name *Helicostyla*, but the second one he renamed *Orthostylus*. He still, however, kept them in separate "tribes" (or families). Pilsbry's citation of Article 28 of the International Rules [3] has no bearing on the point in question, as Beck was not uniting two subgenera or genera to form one, but on the contrary was retaining both groups, merely suppressing one of Férussac's names in favor of a new designation.

---

[1] Tableau systématique de la famille des limaçons, p. 24, 1821.

[2] Index molluscorum praesentis aevi musei principis angustissimi Christiani Frederici, pp. 36, 49, 1837.

[3] See Nautilus vol. 46, p. 71, 1932.

Subsequent authors, Pfeiffer (1841–1877), Gray (1847), Albers, and the Adams brothers, all kept *Helicostyla* and *Cochlostyla* separate in different genera or supergeneric categories. Pfeiffer, it may be noted, in the first part of his Symbolae [4] recognized *Cochlostyla* Férussac as one of his 18 valid genera, going still further in his restriction of the group than Beck, while *Helicostyla* he submerged in *Helix*. Later, however, in the same work he united *Cochlostyla* with *Bulimus*.

Von Martens, in his version of Albers' work [5] was the first one to unite these two groups into one genus, which he called *Cochlostyla*, making *Helicostyla* the second subgenus under it. Hence von Martens is to be considered the first reviser, and the name he chose for the genus will stand according to Article 28 of the International Rules.

Thereafter, for 35 years, *Cochlostyla* was universally used for this group by such authors as Dohrn, Kobelt, Clessin, Nevill, Hidalgo, Semper, von Möllendorff, Fischer, E. A. Smith, Fulton, and Pilsbry (1891).

In 1895, however, Pilsbry, in his "Guide to the Study of the Helices" [6] made *Helicostyla* the name of the genus in place of *Cochlostyla*, because of its prior position in Férussac's work and because of Beck's restriction and use of the subgenus *Helicostyla*. But we have shown that Beck maintained both groups equally, merely changing the name of *Cochlostyla* for some reason to *Orthostylus*. Both groups remained equally a heterogeneous mixture, *Helicostyla* containing three species of *Cochlostyla* and five of *Cepolis*, while *Cochlostyla* included seven species of *Cochlostyla* and seven of *Amphidromus*, besides an *Ampelita* and a *Caryodes*.

The first type designation for *Helicostyla* is apparently that of von Martens,[7] who cited *Cochlostyla mirabilis* Férussac as type. Gray's designation of the same species might be considered questionable, as he uses the combination *Helicostyla* Beck, 1837. The first designation of *Cochlostyla* seems to be that of Pilsbry,[8] who named *Cochlostyla metaformis* as type.

I shall not discuss specific problems in this introduction, preferring to treat these under the species that present points of particular interest. I have been largely influenced by problems of distribution and factors of isolation producing fixation, and the forms here named are zoogeographic races and not merely individual variations of size, shape, or color, which, though they look distinct when viewed separately, may be the offspring of one mother.

---

[4] Symbolae ad historiam heliceorum, vol. 1, pp. 5, 21, 1841.

[5] Die Heliceen, ed. 2, p. 173, 1860.

[6] Man. Conch., ser. 2, vol. 9, pp. 217–218, 1895.

[7] Albers, Die Heliceen, ed. 2, p. 175, 1860.

[8] Nautilus, vol. 46, p. 71, 1932.

I am deeply indebted to the Coast and Geodetic Survey of the United States Department of Commerce for the splendid chart of Mindoro and the adjacent islands, no. 10, from which I am reproducing as plate 117 the northwestern end, as plate 116 the northeastern end, and as plate 118 the southern end; also as plate 119 the islands stretching to the northwest of Mindoro and as plate 120 those to the southeast of Mindoro. These plates show the territory where collecting has been done and also call attention to the large part of the interior, especially of the central portion of the island, still awaiting exploration and from which we may look for many new things.

A careful examination of these contour maps will reveal the greatly diversified topography of this province. We have here mountaintop after mountaintop rising to great elevations, Mount Halcon, its highest peak, registering 8,865 feet. A subsidence of comparatively little moment would split the region into many lesser islands, a fact that accounts for its greatly diversified fauna. The factors of isolation on these circumscribed areas over a long period have made possible the adjustments of the chemical constituents of the germ cells, as well as the adjustments of the organism as a whole, to the environmental factors presented by the restricted habitat.

Cochlostylas are tree snails that require a forest or tree habitat for their existence, and they are as effectively limited in their wanderings by the lowland cogon grass-covered areas as they would be if water separated the areas occupied by them.

Genus COCHLOSTYLA Férussac

In this extremely large genus, the shell presents an enormous range of variation in form. It may be lenticular, helicoid, or bulimoid; it may be nonumbilicate, rimate, or narrowly umbilicate; the outer lip may be almost without reflection or it may be strongly expanded and reflected. The columella may be simple, twisted, or toothed. The surface of the shell is covered by a periostracum, which is usually more or less hydrophanous and varies from a scarcely perceptible to a heavy cuticle. The sculpture never attains the strength of ribs, but the lines of growth in some species approach ribbing. Incised spiral lines or fine striations are usually present.

The shell of some species is unicolor, while others show axial bands or fulgurations, and may have spiral color bands that may be confined to the periostracum or may be part of the substance of the shell. Many colors and tints are represented in the color scheme of the genus.

Of the rest of the anatomy, Dr. Pilsbry states: [9]

---

[9] Man. Conch. ser. 2, vol. 9, pp. 216–217, 1895.

Foot without pedal margination; a small left body-lappet often developed; kidney elongated.

Jaw ribbed.

Radula with bluntly pointed or truncated mesocones on middle and lateral teeth, *without trace of side cusps.* Marginal teeth having the entocone indicated by a split in the broad inner cusp, a small simple ectocone being developed.

Genital system: Penis moderately long, passing into an epiphallus which bears the retractor; flagellum wanting. *Dart sack short and globose,* seated on atrium or low on vagina, *bearing an accessory sack into which the mucus gland opens. Mucus gland globular or oval, with a very short duct,* its thick wall composed of radially arranged follicles. Dart short, straight, and round in section. Spermatheca oval, on a long, branchless duct.

Cochlostylas are arboreal. The genus is almost wholly Philippine; a few species extend into Borneo, south to New Guinea, Moluccas, and the Solomon Islands. The genus has been divided into a host of subgenera or groups, a few of which, usually small aggregates, have quite distinctive characters, but most of them have members that represent bridging elements, which could be placed with equal claim in either of two of these groups. These subgroups, however ill defined they may appear to be, serve a useful purpose in a classificatory arrangement, and it is for that reason chiefly that most of them deserve retention.

Subgenus CORASIA Albers

In this subgenus the shell is depressed helicoid or lenticular, imperforate, usually with a more or less conspicuous peripheral keel. The outer lip is but slightly expanded and reflected. The periostracum is not hydrophanous.

Type: *Cochlostyla* (*Corasia*) *virgo* (Broderip).

A single species only, *Cochlostyla* (*Corasia*) *aegrota* (Reeve), is known from the Mindoro Province.

COCHLOSTYLA (CORASIA) AEGROTA (Reeve)

PLATE 94, FIGURES 1–3

1851. *Helix aegrota* REEVE, Conchologia iconica, pl. 22, fig. 95.
1853. *Helix aegrota* PFEIFFER, Monographia heliceorum viventium, vol. 3, pp. 191–192.
1854. *Helix aegrota* PFEIFFER, Martini-Chemnitz Conchylien Cabinet, ed. 2, vol. 1, Abt. 12, Theil 3, pp. 437–438, pl. 152, fig. 3.
1856. *Helix* (*Corasia*) *aegrota* PFEIFFER, Malakozool. Blätter, vol. 2, p. 144.
1859. *Helix aegrota* PFEIFFER, Monographia heliceorum viventium, vol. 4, p. 214.
1860. *Corasia aegrota* MARTENS, Albers, Die Heliceen, ed. 2, p. 171.
1868. *Helix aegrota* PFEIFFER, Monographia heliceorum viventium, vol. 5, p. 258.
1876. *Helix aegrota* PFEIFFER, Monographia heliceorum viventium, vol. 7, p. 328; in part.
1890. *Cochlostyla aegrota* HIDALGO, Obras malacologicas, p. 152; in part.
1890. *Cochlostyla aegrota* MÖLLENDORFF, Ber. Senckenberg Naturf. Ges., 1890, pp. 230–231; in part.

1890. *Cochlostyla aegrota* Pilsbry, Man. Conch., ser. 2, vol. 6, p. 124 (in part), pl. 26, fig. 1.
1891. *Helix aegrota* Hidalgo, Obras malacologicas, pl. 21, fig. 8.
1895. *Helicostyla aegrota* Pilsbry, Man. Conch., ser. 2, vol. 9, p. 219.
1898. *Cochlostyla aegrota* Möllendorff, Abh. Naturf. Ges. Görlitz, vol. 22, p. 105.
1908. *Cochlostyla aegrota* Möllendorff, Kobelt, and Winter, Semper's Reisen im Archipel der Philippinen, vol. 10, pp. 107–108 (in part), pl. 21, fig. 4.
1932. *Cochlostyla* (*Corasia*) *aegrota* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 335.

Shell thin, semitranslucent, depressed helicoid, with broadly conic spire, feebly angulated periphery, and a short, well-rounded, imperforate base. The shell is covered with a very thin periostracum, which is of a faint greenish yellowish tint, the shell substance itself being white with a bluish tint. Nuclear whorls 1.5, well rounded, smooth, forming an almost planorboid spire. The postnuclear whorls are strongly rounded and appressed at the summit, the appressed portion appearing as a slender white thread on the later whorls. They are marked by retractively curved, almost threadlike incremental lines, which are of irregular strength and spacing. These incremental lines are also present on the base. The early postnuclear whorls show indication of spiral sculpture, which becomes much enfeebled on the later turns. The aperture is broadly oval; interior bluish white; the peristome is narrowly expanded and reflected; the inner lip is rather broad, slightly excavated, and slightly sinuous. The parietal wall is covered by a moderately thick translucent callus.

The specimen described and figured, U.S.N.M. no. 314079, was collected by Quadras on Mindoro and is without specific locality. It has 4.6 whorls and measures: Length, 29.3 mm; greater diameter, 40 mm.

Subgenus CALOCOCHLEA Hartmann

In this subgenus the shell is helicoid or subglobose, imperforate. The periostracum is conspicuously marked with varied hydrophanous patterns.

Type: *Cochlostyla* (*Calocochlea*) *pulcherrima* (Sowerby).

There are a number of species of this subgenus from Mindoro Province. They are:

Cochlostyla (*Calocochlea*) *melanocheila* (Pfeiffer).
C. (*C.*) *perpallida* Bartsch.
C. (*C.*) *aopta* (Clench and Archer).
C. (*C.*) *roissyana* (Férussac).
C. (*C.*) *gertrudis* Möllendorff, Kobelt, and Winter.

COCHLOSTYLA (CALOCOCHLEA) MELANOCHEILA (Pfeiffer)

Plate 94, Figures 4–7

1840. *Helix melanocheylos*? var. *lineolata* Grateloup, Act. Soc. Linn. Bordeaux, vol. 11, p. 163; not *Helix lineolata* Lamarck, 1822, Animaux sans vertèbres, vol. 6, p. 67.

1840. *Helix melanocheilos lineolata* Grateloup, Act. Soc. Linn. Bordeaux, vol. 11, pp. 397, 398, pl. 4, fig. 2.
1841. *Helix brunnea* Sowerby, Proc. Zool. Soc. London, 1841, p. 40.
1842. *Helix brunnea* Pfeiffer, Symbolae, vol. 2, p. 69; not *Helix brunnea* Anton, 1839.
1842. *Helix melanocheila* Pfeiffer, Symbolae, vol. 2, p. 32.
1848. *Helix melanocheila* Pfeiffer, Monographia heliceorum viventium, vol. 1, p. 248.
1849. *Helix melanocheila* Pfeiffer, Martini-Chemnitz Conchylien Cabinet, ed. 2, vol. 1, Abt. 12, Theil 1, p. 276 (in part), pl. 44, figs. 9, 10.
1850. *Callicochlias melanocheila* Albers, Die Heliceen, ed. 1, p. 106.
1851. *Helix melanocheila* Reeve, Conchologia iconica, pl. 19, figs. 80a, 80b.
1851. *Helix melanocheila* Deshayes, Férussac's Histoire naturelle . . . mollusques . . ., vol. 1, p. 296, pl. 107, fig. 14.
1853. *Helix melanocheila* Pfeiffer, Monographia heliceorum viventium, vol. 3, p. 187.
1855. *Helix* (*Callicochlias*) *melanocheila* H. and A. Adams, The genera of recent Mollusca, vol. 2, p. 192.
1856. *Helix* (*Callicochlias*) *melanochela* Pfeiffer, Malakozool. Blätter, vol. 2, p. 143.
1859. *Helix melanocheila* Pfeiffer, Monographia heliceorum viventium, vol. 4, p. 209.
1860. *Callicochlias melanocheila* Martens, Albers, Die Heliceen, ed. 2, p. 173.
1868. *Helix melanocheila* Pfeiffer, Monographia heliceorum viventium, vol. 5, p. 281.
1876. *Helix melanocheila* Pfeiffer, Monographia heliceorum viventium, vol. 7, p. 323; in part.
1877. *Cochlostyla melanocheila* Semper, Reisen im Archipel der Philippinen, vol. 3, pt. 2, p. 181.
1887. *Cochlostyla melanocheila* Hidalgo, Journ. Conchyl., vol. 35, p. 125.
1892. *Cochlostyla* (*Calocochlea*) *melanocheila* Pilsbry, Man. Conch., ser. 2, vol. 7, p. 150, pl. 30, figs. 17–19.
1895. *Helicostyla melanochila* Pilsbry, Man. Conch., ser. 2, vol. 9, p. 223.
1896. *Cochlostyla melanochila* Elera, Catalogo sistematico de toda la fauna de Filipinas, vol. 3, pp. 75–76.
1897. *Cochlostyla melanocheila* Hidalgo, Journ. Conchyl., vol. 44, pp, 266, 296, 330, 331, 341, 351.
1898. *Cochlostyla melanochila* Möllendorff, Abh. Naturf. Ges. Görlitz, vol. 22, p. 114.
1901. *Cochlostyla melanocheila* Hidalgo, Obras malacologicas, pt. 1, pp. 287–288, pl. 40, figs. 2, 3.
1909. *Cochlostyla* (*Callicochlias*) *melanochila* Möllendorff, Kobelt, and Winter, Semper's Reisen im Archipel der Philippinen, vol. 10, pp. 157–158, pl. 31, fig. 6.
1932. *Cochlostyla* (*Calocochlea*) *melanocheila* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 335.
1933. *Helicostyla* (*Calocochlea*) *melanochila* Clench and Archer, Papers Michigan Acad. Sci., Arts, Letters, vol. 17, p. 539.

Shell helicoid, covered with a rather thick periostracum of more or less wood-brown color, variously banded with spiral zones of darker brown. There is usually an almost black band of brown immediately above the periphery, while the peripheral zone in most instances, or at least the space immediately below it, is a light zone of varying width. The periostracum on the base is usually lighter than on the upper surface and is banded with lighter spiral zones of varying width. The periostracum is darker brown, while the interior of the aperture is bluish white. The nuclear whorls are about 2, depressed, moderately well rounded, marked by lines of growth and the last portion of the last turn by the beginning of fine incised spiral lines. The postnuclear whorls are well rounded, appressed at the summit, and marked by fine incremental lines and spiral striations. The latter are stronger on the first postnuclear whorls than on the remaining turns. Periphery obsoletely angulated. Base somewhat inflated, strongly rounded. The aperture is broadly oval. The peristome is moderately strong, expanded, and reflected; the inner lip is somewhat excavated and gently curved.

This species seems to be widely distributed over northeastern Mindoro where it varies considerably in coloring and size.

A series of 78 specimens yields the following measurements:

U.S.N.M. no.	Number of whorls	Length	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
106361	4. 6	32. 6	41. 1	32. 9
106361	4. 4	29. 4	41. 2	33. 0
130818	5. 0	31. 9	40. 6	34. 5
195407	4. 3	32. 2	47. 5	36. 3
195407	4. 5	30. 6	44. 7	34. 5
195407	4. 6	32. 8	46. 0	36. 0
195407	4. 7	30. 2	40. 9	32. 0
255821	4. 5	30. 6	43. 3	33. 6
255821	4. 5	28. 9	42. 9	33. 9
255821	4. 7	31. 7	41. 9	32. 2
255821	4. 6	27. 3	40. 3	31. 1
255821	4. 8	33. 5	44. 7	35. 9
255821	4. 6	31. 6	45. 5	35. 3
255821	4. 5	30. 3	42. 6	33. 5
255821	4. 4	30. 9	42. 1	32. 6
255821	4. 3	31. 6	48. 6	37. 0
255821	4. 4	30. 1	43. 4	34. 0
255821	4. 3	26. 6	38. 9	29. 9
255830	4. 6	30. 4	45. 7	35. 8
255830	4. 5	30. 7	42. 8	33. 0
255830	4. 4	26. 5	38. 2	29. 8
255830	4. 5	29. 5	41. 8	33. 2
255830	4. 6	32. 9	45. 2	34. 8
255830	4. 3	32. 0	42. 9	33. 1
255830	4. 6	32. 3	43. 5	34. 6
255830	4. 5	30. 1	44. 7	33. 7
255830	4. 4	26. 1	38. 2	29. 8
255830	4. 3	30. 0	43. 2	33. 2
255830	4. 5	31. 2	44. 4	34. 3
255830	4. 3	28. 3	42. 4	32. 4
256167	4. 7	35. 0	46. 2	35. 8
256167	4. 5	30. 8	42. 6	32. 9
256167	4. 5	33. 4	44. 6	35. 6
256167	4. 6	33. 0	44. 3	34. 3
256167	4. 6	32. 2	43. 1	33. 4

U.S.N.M. no.	Number of whorls	Length	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
256167	4.5	29.0	40.1	32.1
256167	4.7	35.8	48.1	38.0
309382	4.9	33.8	44.8	35.2
309399	4.6	31.7	39.9	31.9
313561	4.6	34.7	44.5	34.9
313562	4.2	29.2	43.6	33.0
313563	4.8	35.7	47.7	38.0
313564	4.4	29.4	40.7	32.0
313564	4.5	33.1	44.9	34.5
313564	4.6	32.3	43.2	34.9
313564	4.8	34.3	45.2	35.5
313564	4.6	32.4	43.8	34.4
313564	4.5	30.3	44.3	34.3
313564	4.7	33.7	44.2	35.7
313564	4.6	34.6	41.6	33.2
313564	4.6	30.0	40.6	31.5
313564	4.9	30.8	39.3	31.3
313564	4.6	30.4	39.1	31.6
313565	4.7	34.3	46.4	35.8
313565	5.0	34.7	45.9	36.0
313565	4.4	30.1	44.1	34.4
313565	4.5	31.6	46.9	35.5
313565	4.4	31.2	43.0	33.2
313565	4.2	29.5	42.5	34.1
313565	4.6	34.7	46.3	35.8
313565	4.3	30.4	39.8	31.5
313565	4.6	29.8	38.6	30.6
313565	4.3	31.0	43.3	33.8
313565	4.8	31.7	42.6	33.2
313566	4.5	31.2	45.1	36.0
313566	4.4	28.4	39.2	30.8
313566	4.4	27.5	38.4	30.7
313566	4.8	27.8	36.7	29.3
313567	4.5	32.6	43.0	33.7
313567	4.6	32.5	48.3	37.5
313567	4.4	33.6	46.3	35.9
313567	4.6	31.0	41.2	33.0
313567	4.3	30.0	42.8	33.4
313567	4.6	32.1	45.6	35.9
313567	4.8	34.1	42.7	33.8
313567	4.4	30.5	42.8	33.3
313567	4.6	31.7	45.5	35.4
313567	4.9	33.8	42.3	33.2
Average	4.55	31.34	43.14	33.84
Greatest	5.00	35.8	48.6	38.0
Least	4.20	26.1	36.7	29.3

I am reproducing (pl. 94, figs. 4–7) Grateloup's figure and also figures of a perfect specimen from San Teodoro, Mindoro.

COCHLOSTYLA (CALOCOCHLEA) PERPALLIDA Bartsch

PLATE 94, FIGURES 8–10

1932. *Cochlostyla* (*Calocochlea*) *perpallida* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 335.

The nuclear whorls and the ground color of the postnuclear whorls are white. Where the periostracum remains there seems to be a basal film of straw color, upon which is superimposed a thin film of wood brown, which is variously spirally banded with darker brown. On the base these bandings become more emphasized. The interior of the aperture and the peristome are white. Nuclear whorls 2.1, well rounded, marked by incremental lines, and the last portion of the last turn by the beginning of fine spiral striations. The postnuclear whorls are strongly rounded and marked by fine incremental lines and fine, closely approximated, spiral striations, which are conspicuously developed on all the turns, as well as on the base. The summit of the whorls is appressed; the periphery feebly angulated; the base inflated and strongly rounded. The aperture is broadly oval, almost subcircular, oblique. The outer lip is moderately expanded and reflected; the inner lip is decidedly oblique and almost straight, the columellar side being somewhat excavated and covered by a thin white callus, which also extends over the parietal wall.

The type (U.S.N.M. no. 313568) was collected by Pedro de Mesa at Tabukala near San Teodoro, Mindoro. It has 4.6 whorls and measures: Length, 37.2 mm; greater diameter, 47 mm; lesser diameter, 35.3 mm.

This species strongly suggests *Cochlostyla* (*Calocochlea*) *melanocheila* in general size and the hydrophanous markings of the periostracum, but the ground color of the nuclear whorls, the aperture, and expanded peristome are white instead of dark. The aperture and columella also are more oblique. I am therefore inclined to believe that it is not merely a color phase of *melanocheila*.

COCHLOSTYLA (CALOCOCHLEA) AOPTA (Clench and Archer)

1933. *Helicostyla* (*Calocochlea*) *aopta* Clench and Archer, Papers Michigan Acad. Sci., Arts, Letters, vol. 17, p. 542, pl. 57, fig. 3.

"Shell imperforate, globose, rather solid. Nuclear whorl white, gradually shading off into darkish, dull yellow on the body whorl. From the nuclear whorl onward a brownish red subsutural band; from about one and one-half whorls from the nuclear whorl a reddish, gradually widening, gradually darkening band situated a short distance above the suture and continuing as a superperipheral band on the body whorl; a broad, brownish band on the body whorl just below the periphery. A brown circumcolumellar band present; aperture white; peristome and columella white; a slight hydrophanous cuticle appearing on the body whorl in the form of axial streaks cutting across the bands. Whorls 4, rounded, gradually increasing, and quite broad in back of the peristome; spire somewhat elevated; aperture broadly oblique and open; peristome rounded, moderately expanded and recurved; columella broad, slanting from the basicolumellar region sharply inward toward the parietal wall; parietal callus extremely thin; suture moderately impressed. Sculpture consisting of crowded axial folds or lines, indistinct on the nuclear whorl, but gradually becoming plainer beyond that area."

The holotype (Mus. Comp. Zoöl. no. 81354) was collected between Puerto Galera and San Teodoro, Mindoro, by Pedro de Mesa. It measures: Altitude, 35.5 mm; diameter, 39.5 mm; aperture height, 21 mm; aperture width, 20 mm.

"This interesting new species is unfortunately represented by but a single specimen. It has hitherto been overlooked and may be quite rare. It bears a resemblance to several species from Luzon. It seems closest to *H. persimilis* Fér. It is a duller yellow with lighter bands and a narrower peristome, and is more depressed, having wider whorls."

As this species was described by Clench and Archer after our manuscript was turned in for publication, we are unable to include a figure of it in this paper.

COCHLOSTYLA (CALOCOCHLEA) ROISSYANA (Férussac)

Shell of medium size, helicoid, subglobular. The different subspecies vary materially in the color of the periostracum as well as in the color of the substance of the shell. In some both periostracum and shell are white; in others the periostracum is pale straw color, in others deeper yellow turning toward orange, while in still others it may be wood brown and almost black. The thickness of the periostracum is also decidedly variable. In some of the races it is thin, almost evanescent, while in others it is rather thick. The shell may be without bands; when this occurs, it is usually in the dark-colored forms, but even there banding is present in most specimens. In some races the banding is confined to a narrow zone on the summit of the whorls and the umbilical area, while in others a number of spiral bands are present between the summit and the umbilicus. The interior of the aperture in all the specimens before me is bluish white, even in the almost black individuals, and the peristome is edged with dark brown, although in one race, *C.* (*Calocochlea*) *roissyana cavitala*, from Mount Calavite, the dark peristome is less accentuated. Nuclear whorls about 2, slightly rounded, marked by fine incremental lines and on the last portion of the last turn by the beginning of spiral striations. The postnuclear whorls are strongly rounded, appressed at the summit, and marked by fine incremental lines and very fine spiral striations. The periphery is feebly obsoletely angulated. Base inflated, strongly rounded, and having the same sculpture as the spire. The aperture is subcircular, slightly oblique. The peristome is slightly expanded and reflected; the columella is rather stout and oblique and slightly excavated.

I am recognizing a number of subspecies or geographic races, which appear to have circumscribed habitats.

Hidalgo [10] referred *Helix infuscata* Albers here as a subspecies. I do not agree with him on this point. It is not a member of the *Cochlostyla roissyana* complex; nor do I accept his references of this species occurring in the islands of Tablas, Leyte, and Mindanao. These evidently rest upon misidentifications.

KEY TO THE SUBSPECIES OF COCHLOSTYLA (CALOCOCHLEA) ROISSYANA

Shell with peripheral keel -- monacha
Shell without peripheral keel.
  Shell dark brown.
    Shell with many bands -- bartschi
    Shell not with many bands.
      Outer lip very dark ------------------------------------ subatra
      Outer lip light --- lutea
  Shell not dark brown.
    Shell orange -- lutea
    Shell not orange.
      Shell of light ground color.
        Periostracum pale lemon.
          Dark spiral bands predominating over the light zones. cavitala
          Dark spiral bands not predominating over the light zones. roissyana
        Periostracum not pale lemon.
          Periostracum pale straw color.
            Band at the summit broad -------------- manlaysa
            Band at the summit narrow ------------- laymansa

COCHLOSTYLA (CALOCOCHLEA) ROISSYANA MONACHA (Clench and Archer)

1933. *Helicostyla* (*Calocochlea*) *roissyana monacha* CLENCH and ARCHER, Papers Michigan Acad. Sci., Arts, Letters, vol. 17, p. 539, pl. 57, fig. 1.

"Shell imperforate, globose, rather solid. Nuclear whorl ivory-yellow, which continues onward to the edge of the peristome and becomes slightly tinged with brown. From the nuclear whorl onward a subsutural dark brown band, at first very narrow, but gradually widening; from the first whorl succeeding the nuclear whorl onward a supersutural dark brown band, at first very slight, but rather rapidly widening until it develops into a strong band above the periphery of the body whorl. Just below the periphery of the body whorl an ivory-yellow band covered most of the way by a thick cartridge-buff zone of hydrophanous cuticle; below the subperipheral yellow band a broad dark brown zone covering most of the base, but interrupted near the columella by another yellowish band, and inside that a dark brown circumcolumellar band. Body whorl suffused by a rather light hydrophanous cuticle ornamented by spiral lines at irregular distances from one another, these in turn being cut across by rather faint axial lines. As already mentioned, there is a subperipheral band of hydrophanous cuticle. Peristome blackish brown; columella white; aperture white; whorls 4, only slightly convex, body whorl keeled; spire rather flat; peristome narrow, rounded, slightly reflected, slightly recurved; columella broad, flat, and rather straight, slanting at 111° angle from the basal lip inward toward the parietal wall; parietal callus thin, aperture dome-shaped; suture very slightly impressed. Sculpture consisting of closely crowded axial striae, cut across by spiral lines, which are especially common below the periphery of the body whorl."

---

[10] Obras malacologicas, p. 464, 1901.

Holotype (Mus. Comp. Zoöl. no. 81353) collected at Binuañgan, Palúan, Mindoro, by Pedro de Mesa. It measures: Altitude, 33.5 mm; diameter, 39.5 mm; aperture height, 17.5 mm; aperture width, 16.5 mm.

"This species is readily distinguishable from *H. melanochila* by its keel and its higher spire. The stronger development of spiral lines is another difference. Its lighter color, especially on the spire, and scantier hydrophanous cuticle are other distinguishing characteristics. It also has a stronger columella. It is unique among the known Helicostylae of the section *Calocochlea* which occur in Mindoro in possessing a definite keel. The species is probably rare; only one specimen is known."

COCHLOSTYLA (CALOCOCHLEA) ROISSYANA BARTSCHI (Clench MS.) Bartsch

Plate 95, Figures 10–12

1932. *Cochlostyla* (*Calocochlea*) *roissyana bartschi* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 335.

1933. *Helicostyla* (*Calocochlea*) *roissyana bartschi* Clench and Archer, Papers Michigan Acad. Sci., Arts, Letters, vol. 17, p. 541, pl. 17, fig. 2.

Shell subglobular; the nuclear and early postnuclear whorls are flesh-color, gradually changing to brown. There is a narrow dark zone at the summit and another showing immediately posterior to the periphery. The periphery is pale buff, while the base is dark brown, with an obscure lighter median zone. The interior of the aperture and columella are bluish white, while the outer lip is dark. The entire shell is covered by a pale gray periostracum, which shows various hydrophanous spiral bands both on spire and base.

The 20 specimens of this race in our collection, collected by Pedro de Mesa at Anduyanan, Paluan, Mindoro, are so uniform, both in general form and coloration, that I do not hesitate to consider this a good race. They yield the following measurements:

U.S.N.M. no.	Number of whorls	Height	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
313588	5.2	31.7	33.4	28.4
313588	5.1	32.7	33.7	28.4
313588	5.0	28.6	32.5	27.5
313588	5.1	31.2	34.0	29.2
313588	5.2	33.3	32.2	27.7
313588	5.2	33.8	35.5	29.6
313588	5.3	32.7	33.3	29.0
313588	5.1	31.4	32.9	28.5
313588	5.1	29.7	32.5	27.3
313588	5.4	35.9	33.9	29.6
313588	5.1	32.8	33.5	28.3
313588	5.0	33.2	34.8	30.5
313588	5.1	31.3	33.1	28.6
313588	5.2	33.5	33.3	29.3
313588	5.4	31.8	31.7	27.1
313588	5.3	34.2	34.2	29.7
313588	5.1	29.5	33.0	27.8
313588	5.2	30.9	32.8	27.4
313588	5.6	35.5	32.3	28.2
313588	5.4	34.8	33.6	29.9
Average	5.2	32.42	33.31	28.6
Greatest	5.6	35.9	35.5	30.5
Least	5.0	28.6	31.7	27.1

COCHLOSTYLA (CALOCOCHLEA) ROISSYANA SUBATRA Pilsbry

PLATE 95, FIGURES 7–9

1841. *Helix roissyana* var. *d* SOWERBY, Proc. Zool. Soc. London, 1840, pp. 101–102; in part.

1846. *Helix roissyana* PFEIFFER, Martini-Chemnitz Conchylien Cabinet, ed. 2, vol. 1, Abt. 12, Theil 2, pp. 283–284 (in part), pl. 47, fig. 3.

1851. *Helix roissyana* REEVE, Conchologia iconica, pl. 18, figs. 73b, 73c.

1887. *Cochlostyla roissyana* HIDALGO, Journ. Conchyl., vol. 35, p. 146; in part.

1892. *Cochlostyla roissyana subatra* PILSBRY, Man. Conch., ser. 2, vol. 6, p. 152, pl. 30, fig. 28.

1895. *Helicostyla roissyana subatra* PILSBRY, Man. Conch., ser. 2, vol. 9, p. 223.

1898. *Cochlostyla roissyana cuticulare* MÖLLENDORFF, Abh. Naturf. Ges. Görlitz, vol. 22, p. 122.

1898. *Cochlostyla roissyana subatra* MÖLLENDORFF, *ibid.*, p. 122.

1901. *Cochlostyla roissyana* var *o* HIDALGO, Obras malacologicas, p. 466, pl. 51, fig. 2.

1910. *Cochlostyla roissyana subatra* MÖLLENDORFF, KOBELT, and WINTER, Semper's Reisen im Archipel der Philippinen, vol. 10, pp. 204–205 (in part), pl. 42, fig. 3.

1910. *Cochlostyla roissyana cuticulare* MÖLLENDORFF, KOBELT, and WINTER, *ibid.*, pp. 204–205 (in part), pl. 42, fig. 4.

1932. *Cochlostyla* (*Calocochlea*) *roissyana subatra* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 335.

1933. *Helicostyla* (*Calocochlea*) *roissyana cuticularis* CLENCH and ARCHER, Papers Michigan Acad. Sci., Arts, Letters, vol. 17, p. 541.

Shell varying from decidedly subglobular to elevated helicoid. The nuclear whorls may be dark or light, and the coloration varies from dark brown to orange. The postnuclear whorl is usually light, with a zone of brown at the summit and frequently a narrow line of brown showing above the suture. Both of these brown lines as a rule gradually increase in width until they entirely blot out the light zone between them. The base is usually unicolor, although sometimes the umbilical area, which is dark, is bordered by a little paler zone posteriorly. The interior of the aperture is bluish white, and the outer lip is brown; the columellar area though white is occasionally tinged with brown. When the periostracum is present this is usually of a dull wood-brown color, sometimes faintly spirally lined.

I have two shells before me that are pale orange and suggest in their color scheme the orange form from Ilin Island, but in shape they conform more with *subatra*. There is no definite locality mentioned. A series of 38 specimens yields the following measurements:

U.S.N.M. no.	Number of whorls	Length	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
313618	4.7	29.1	33.0	27.9
313593	4.9	30.0	35.1	30.4
313593	5.2	30.6	34.6	29.7
313593	5.1	32.0	32.8	28.4
313593	4.8	32.3	36.0	30.3
195433	5.1	30.4	31.1	27.4
195433	5.0	27.4	29.8	25.9
103953	4.9	29.2	34.3	28.7
309480	5.0	30.0	30.4	26.1
309480	5.0	28.4	28.5	24.7
309480	5.1	31.0	30.6	26.8
20413	5.2	35.2	35.3	30.6
20414	4.9	31.3	32.6	27.7
7594	5.3	34.1	34.4	29.3
7594	5.1	32.7	34.4	29.7
7594	4.9	30.6	33.0	27.8
105270	5.1	27.3	28.1	24.1
43521	5.1	28.2	28.8	25.5
104376	5.2	32.7	32.8	28.0
99902	5.0	32.0	32.0	27.1
106367	4.6	25.9	29.7	24.5
103953	5.4	33.7	34.8	30.9
106366	5.3	32.2	32.3	29.2
21835	5.3	28.3	31.2	25.9
315750	4.6	28.8	30.0	26.9
1272	5.0	30.2	32.3	28.3
1272	4.7	27.4	29.1	25.6
20418	4.7	27.2	31.0	26.7
20418	5.4	31.3	32.7	28.3
20418	5.1	29.8	32.5	27.8
99895	5.0	27.0	30.0	24.9
31752	5.0	32.1	34.8	28.7
99902	5.0	28.4	31.1	26.7
99902	4.9	27.7	30.2	26.0
105283	5.2	28.1	29.9	26.1
105283	5.0	26.2	31.7	27.1
315749	4.9	32.3	37.1	31.5
20414	5.0	32.2	34.6	29.8
Average	5.02	30.09	32.17	27.66
Greatest	5.4	35.2	37.1	31.5
Least	4.6	25.9	28.1	24.1

The present race can be distinguished from the dark race from Ilin Island by its larger size and dark lip.

COCHLOSTYLA (CALOCOCHLEA) ROISSYANA LUTEA (Pfeiffer)

PLATE 95, FIGURES 1–6

1869. *Helix roissyana* var. PFEIFFER, Novitates conchologicae, vol. 3, p. 497, pl. 107, figs. 10, 11.
1876. *Helix roissyana lutea* PFEIFFER, Monographia heliceorum viventium, vol. 7, p. 324.
1892. *Cochlostyla roissyana lutea* PILSBRY, Man. Conch., ser. 2, vol. 6, p. 152, pl. 30, figs. 23, 24.
1895. *Helicostyla roissyana lutea* PILSBRY, Man. Conch., ser. 2, vol. 9, p. 223.
1989. *Cochlostyla roissyana lutea* MÖLLENDORFF, Abh. Naturf. Ges. Görlitz, vol. 22, p. 122.
1901. *Cochlostyla roissyana* var. *c* HIDALGO, Obras malacologicas, pt. 1, p. 465.
1901. *Cochlostyla roissyana* var. *m* HIDALGO, *ibid.*, p. 466, pl. 122, fig. 2.
1910. *Cochlostyla roissyana lutea* MÖLLENDORFF, KOBELT, and WINTER, Semper's Reisen im Archipel der Philippinen, vol. 10, pp. 204–205; in part.
1932. *Cochlostyla* (*Calocochlea*) *roissyana lutea* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 335.

Ilin Island has a small race of *Cochlostyla* (*Calocochlea*) *roissyana*. Quadras was the first one to point out that the yellow shell that Pfeiffer described and figured in 1869 in his Novitates Conchologicae came from Ilin Island. Four specimens before me, which undoubtedly belong here, agree quite well with Pfeiffer's diagnosis, and they agree so well with the host of material before me in shape, although this is of extremely dark coloration, that I am led to believe that they probably represent only color phases of the Ilin Island race. I am therefore giving a description of both. The typical *Cochlostyla* (*Calocochlea*) *roissyana lutea* figured by Pfeiffer is of orange color with a light band a little distance below the summit, which bears a dark band. Beginning with the next to the last whorl, the light zone more and more covers the whorls until only a narrow suprasutural band and a narrow zone of orange are present at the summit. The base is also of orange color, with the columella and expanded peristome light edged with an orange margin at the outer periphery. The dark shells may be described as follows:

Shell small, globular; nuclear whorls bluish white, the first postnuclear turn soiled flesh-color, the rest brown, usually with an inconspicuous broad median paler brown zone. Base brown. The entire surface is covered by a dull pale grayish brown periostracum. The interior of the aperture and columella are white; the peristome is edged with dark brown. A light zone bordering the dark columellar patch is seen on the parietal wall within the aperture.

The specimens before me were collected by Pedro de Mesa on Ilin Island, south of Mindoro.

The specimens yield the following measurements:

U.S.N.M. no.	Number of whorls	Length	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
106363	4. 8	25. 9	28. 8	24. 6
106363	4. 8	25. 4	29. 2	24. 3
106363	4. 5	27. 0	29. 1	24. 4
106363	4. 7	25. 5	28. 9	24. 2
313594	4. 9	27. 3	29. 8	25. 2
313594	5. 0	27. 1	29. 4	25. 5
313594	4. 5	25. 0	28. 6	25. 5
313594	4. 6	21. 3	25. 7	21. 3
313594	4. 5	26. 0	29. 0	24. 7
313594	4. 9	26. 8	28. 2	24. 8
313594	4. 7	24. 3	29. 5	25. 2
313594	4. 5	27. 0	30. 0	25. 1
313594	4. 5	24. 5	28. 0	23. 8
313594	4. 6	27. 2	31. 1	26. 1
313594	4. 9	26. 6	30. 0	25. 0
313594	4. 6	27. 8	33. 0	27. 5
313594	5. 0	27. 0	29. 1	25. 6
313595	4. 5	22. 2	26. 8	22. 8
313595	4. 9	28. 5	29. 8	26. 0
313595	4. 6	25. 9	30. 6	25. 5
313595	5. 0	26. 6	30. 5	26. 0
313595	5. 0	28. 8	30. 4	26. 8
313595	4. 9	26. 3	31. 0	25. 7
309427	4. 6	23. 3	27. 2	23. 4
Average	4. 7	25. 97	29. 3	24. 9
Greatest	5. 0	28. 8	33. 0	27. 5
Least	4. 5	21. 3	25. 7	21. 3

This race is easily distinguished from the other dark-colored forms by its smaller size. The dark Ilin Island shells are differentiated from those of Mindoro by having the peristome of the outer lip paler, in most instances white or merely edged with brown, while in the Mindoro shells the outer lip is dark.

COCHLOSTYLA (CALOCOCHLEA) ROISSYANA CAVITALA Bartsch

Plate 96, Figures 10–12

1932. *Cochlostyla* (*Calocochlea*) *roissyana cavitala* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 336.

Shell large, subglobular. The nuclear whorls when perfect are covered with a thin olivaceous periostracum. The nuclear whorls and the early postnuclear whorls are flesh-color, with a zone of black near the summit and immediately posterior to the periphery. These zones increase rapidly in size but always maintain between them a broad band of flesh-color. A narrow zone of flesh-color is present on the periphery and still another at the middle of the base. The latter is frequently tinged with brown or reddish brown, the rest of the base being like the bands of the spire, very dark brown. The aperture is bluish white showing the dark bands within. The columella is soiled white, while the outer lip is dark.

The type (U.S.N.M. no. 313589) was collected by Pedro de Mesa at Mount Calavite, Paluan, Mindoro. It has 5.3 whorls and measures: Length, 37.2 mm; greater diameter, 36.5 mm; lesser diameter, 32.2 mm.

Thirteen topotypes (U.S.N.M. no. 313590) from the same source yield the following additional measurements:

U.S.N.M. no.	Number of whorls	Length	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
313590	5. 1	31. 4	28. 8	25. 8
313590	5. 1	34. 3	33. 9	29. 3
313590	5. 5	33. 2	33. 2	28. 1
313590	5. 2	33. 5	33. 3	28. 9
313590	5. 1	30. 6	30. 7	26. 9
313590	5. 0	31. 0	29. 2	25. 8
313590	4. 9	31. 3	34. 7	29. 4
313590	5. 0	34. 2	34. 9	29. 0
313590	5. 2	31. 7	32. 2	27. 3
313590	5. 1	34. 9	34. 2	29. 3
313590	5. 0	32. 3	34. 6	29. 4
313590	5. 2	33. 5	34. 8	30. 2
313590	4. 9	28. 0	31. 7	26. 9

U.S.N.M. no. 313591 contains nine specimens from Calawagan, northeastern Mindoro, which in part agree with the present race and in part tend toward the dark-colored *Cochlostyla* (*Calocochlea*) *subatra*. I am placing them provisionally here. They yield the following measurements:

313591	5. 2	29. 8	31. 2	27. 0
313591	5. 6	36. 1	33. 8	30. 8
313591	5. 4	35. 1	35. 2	30. 8
313591	5. 0	32. 2	31. 0	28. 9
313591	5. 4	34. 0	33. 2	29. 5
313591	5. 4	34. 2	32. 3	28. 8
313591	5. 3	33. 5	33. 2	29. 8
313591	5. 4	41. 0	37. 7	32. 4
313591	5. 2	35. 6	34. 8	30. 6
Average	5. 2	33. 24	33. 11	28. 86
Greatest	5. 6	41. 0	37. 7	32. 4
Least	5. 0	28. 0	28. 8	25. 8

This race differs from *C.* (*C.*) *roissyana bartschi* in being uniformly lighter colored.

COCHLOSTYLA (CALOCOCHLEA) ROISSYANA ROISSYANA (Férussac)

Plate 96, Figures 7–9

1822. *Helix roissyana* Férussac, Tableaux systématiques des animaux mollusques . . . , p. 47; a nomen nudum and manuscript name.

1830. *Helix roissyana* Deshayes, Encyclopédie méthodique, vol. 2, p. 265.

1837. *Helicostyla roissyana* Beck, Index molluscorum praesentis aevi musei principis augustissimi Christiani Frederici, p. 37.

1841. *Helix roissyana* Sowerby, Proc. Zool. Soc. London, 1840, pp. 101–102; in part.
1848. *Helix roissyana* Pfeiffer, Monographia heliceorum viventium, vol. 1, p. 249.
1849. *Helix roissyana* Pfeiffer, Martini-Chemnitz Conchylien Cabinet, ed. 2, vol. 1, Abt. 12, Theil 1, pp. 283–284 (in part), pl. 47, figs. 1, 2.
1850. *Helicostyla roissyana* Albers, Die Heliceen, ed. 1, p. 104.
1850. *Helix roissyana* Deshayes, Férussac's Histoire naturelle . . . mollusques . . . , vol. 1, pp. 297–298, pl. 104, figs. 2, 3; pl. 107, figs. 11–13.
1851. *Helix roissyana* Reeve, Conchologia iconica, pl. 18, text; in part.
1853. *Helix roissyana* Pfeiffer, Monographia heliceorum viventium, vol. 3, p. 187.
1855. *Helicostyla roissyana* H. and A. Adams, The genera of recent Mollusca, vol. 2, p. 192.
1856. *Helix* (*Callicochlias*) *roissyana* Pfeiffer, Malakozool. Blätter, vol. 2, p. 143.
1859. *Helix roissyana* Pfeiffer, Monographia heliceorum viventium, vol. 4, p. 209.
1860. *Helicostyla roissyana* Martens, Albers, Die Heliceen, ed. 2, p. 175.
1868. *Helix roissyana* Pfeiffer, Monographia heliceorum viventium, vol. 5, p. 281.
1876. *Helix roissyana* Pfeiffer, Monographia heliceorum viventium, vol. 7, p. 324.
1877. *Cochlostyla roissyana* Semper, Reisen im Archipel der Philippinen, pt. 2, vol. 3, p. 185.
1887. *Cochlostyla roissyana* Hidalgo, Journ. Conchyl., vol. 35, pp. 146–147; in part.
1892. *Cochlostyla roissyana* Pilsbry, Man. Conch., ser. 2, vol. 7, pp. 151–152, pl. 30, figs. 25–27.
1895. *Helicostyla roissyana* Pilsbry, Man. Conch., ser. 2, vol. 9, p. 223.
1896. *Cochlostyla roissyana* Elera, Catalogo sistematico de toda la fauna de Filipinas, vol. 3, p. 576; in part.
1897. *Cochlostyla roissyana* Hidalgo, Journ. Conchyl., vol. 44, pp. 252, 254, 258, 300, 312, 313, 316, 318, 334, 335, 341, 351.
1898. *Cochlostyla roissyana* Möllendorff, Abh. Naturf. Ges. Görlitz, vol. 22, p. 122.
1901. *Cochlostyla roissyana* Hidalgo, Obras malacologicas, p. 465 (in part), pl. 50 fig. 3; pl. 51, figs. 3–6; pl. 122, fig. 3.
1910. *Cochlostyla roissyana* Möllendorff, Kobelt, and Winter, Semper's Reisen im Archipel der Philippinen, vol. 10, pp. 204–205 (in part), pl. 42, figs. 1, 2.
1932. *Cochlostyla* (*Calocochlea*) *roissyana roissyana* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 335.
1933. *Helicostyla* (*Calocochlea*) *roissyana* Clench and Archer, Papers Michigan Acad. Sci., Arts, Letters, vol. 17, p. 540.

Shell varying from subglobose to helicoid in shape. The early whorls are of a little paler ground color than the later, which are covered with a pale-yellow periostracum. In the specimen figured by Férussac (pl. 104, figs. 2 and 3) there is a brown zone at the summit of the postnuclear turns, a narrow brown zone at the periphery, and a dark zone about the umbilicus. The outer lip is also dark. At variance with this we have specimens without the peripheral brown band and others in which the peripheral brown band is much broader than in the specimen figured, and still others in which there is a broad basal dark brown band about halfway between the peripheral zone and the dark area about the columella. Our plate 96, figure 8, illustrates this. The columella in all our specimens is white, sometimes with a pinkish tinge. Most of our material was collected by Worcester and Bourns on the Menage Expedition.

While our specimens bear numbers, we do not have the data going therewith, but we know that Worcester and Bourns collected about Calapan and Naujan; in other words, in northeastern Mindoro.

A series of 40 specimens yields the following data:

U.S.N.M. no.	Number of whorls	Length	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
106367	4.9	28.3	29.5	25.8
313623	5.0	34.0	34.0	29.8
130822	4.9	28.8	22.1	27.8
313611	4.9	27.9	29.9	26.0
313611	4.9	30.1	32.8	26.3
313611	4.9	26.0	32.9	27.0
313611	5.0	30.3	31.3	26.0
313611	4.9	28.4	32.1	27.8
313611	4.5	28.4	33.2	28.2
313612	5.1	30.2	30.4	26.8
313612	4.8	26.5	29.6	24.9
313612	4.4	27.2	29.3	25.2
313612	4.7	26.5	30.2	25.7
313612	4.6	24.6	29.9	26.3
313612	4.4	25.2	31.9	27.3
313612	5.0	24.9	29.4	25.1
313612	4.5	25.0	29.7	24.8
313612	4.6	26.8	32.0	26.5
313612	4.8	24.6	28.4	24.7
313612	4.7	27.3	28.9	25.5
313612	4.6	26.0	30.2	25.7
313612	4.7	26.2	29.0	24.5
313612	4.7	26.0	30.4	26.5
313612	4.8	27.1	31.5	26.8
313612	4.6	25.0	30.2	25.7
313612	4.7	27.0	31.2	25.8
313612	4.6	27.7	31.6	26.8
313612	4.6	26.5	30.2	25.5
313612	4.7	25.5	28.8	24.9
313612	5.0	29.8	31.8	27.7
313612	4.6	27.4	32.3	27.5
313612	4.6	27.5	31.2	27.0
313612	4.6	27.5	33.1	27.8
313612	4.7	29.0	31.6	27.6
313612	4.7	28.0	30.5	26.0
313612	4.6	27.3	29.0	25.6
106365	5.0	25.8	28.1	23.9
106365	4.7	28.6	31.3	27.5
313613	4.9	27.5	29.3	26.0
106364	4.8	27.5	29.8	26.7
Average	4.74	27.35	30.46	26.32
Greatest	5.1	34.0	34.0	29.8
Least	4.4	24.6	22.1	23.9

The yellow periostracum distinguishes this, the typical race, from the rest.

COCHLOSTYLA (CALOCOCHLEA) ROISSYANA MANLAYSA Bartsch

Plate 96, Figures 1–3

1901. *Cochlostyla roissyana* var. *e* Hidalgo, Obras malacologicas, p. 465, pl. 51, fig. 7.

1932. *Cochlostyla* (*Calocochlea*) *roissyana manlaysa* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 336.

Shell subglobular, with the periostracum almost white, sometimes with a little pinkish tinge. A zone of brown marks the summit of the whorls, and another, usually narrow, may be present immediately above the periphery, or this may be absent. There is always a dark-brown area about the umbilicus and usually a broad band of brown midway between the peripheral zone and the dark umbilical area. The outer lip is dark.

This race is distinguished chiefly from typical *roissyana* by its much paler color. I collected a series of specimens on the east shore of Mansalay Bay, Mindoro.

The type (U.S.N.M. no. 313614) has 5 whorls and measures: Length, 31.6 mm; greater diameter, 34.7 mm; lesser diameter, 29.8 mm.

U.S.N.M. no. 255928 contains a number of topotypes, which yield the following measurements:

U.S.N.M. no.	Number of whorls	Length	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
255928	5.0	31.7	33.9	29.4
255928	4.9	27.4	31.8	27.9
255928	4.9	27.4	32.7	28.3
255928	4.8	28.1	32.7	28.5
255928	5.0	29.7	31.7	28.3
255928	4.6	24.0	30.7	25.6

Additional specimens yield the following measurements:

99903	4.8	29.8	32.3	28.3
99903	4.8	28.6	32.8	28.1
309468	4.7	27.8	31.5	26.3
313615	4.7	29.2	34.8	28.8
99894	4.7	29.0	32.9	28.9
20416	4.8	30.7	34.3	29.9
7594a	5.2	30.4	31.2	28.3
7594a	5.0	28.6	29.2	25.8
7594a	4.8	28.3	31.5	27.5
20416	5.1	31.0	32.0	28.0
20417	5.3	30.7	31.2	27.4
Average	4.89	28.9	32.2	27.9
Greatest	5.3	31.7	34.8	29.9
Least	4.6	24.0	29.2	25.6

COCHLOSTYLA (CALOCOCHLEA) ROISSYANA LAYMANSA Bartsch

Plate 96, Figures 4–6

1851. *Helix roissyana* Reeve, Conchologia iconica, pl. 18, fig. 73a.
1887. *Cochlostyla roissyana* Hidalgo, Journ. Conchyl., vol. 35, p. 146; in part.
1896. *Cochlostyla roissyana* var. Elera, Catalogo sistematico de toda la fauna de Filipinas, vol. 3, p. 576.
1901. *Cochlostyla roissyana* var. *d* Hidalgo, Obras malacologicas, p. 465, pl. 51, fig. 1; pl. 122, fig. 4?.
1932. *Cochlostyla* (*Calocochlea*) *roissyana laymansa* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 336.

Shell rather small, globular, covered with a thin periostracum, which is the color of the blush of a green plum. In all our specimens there is a zone of brown at the summit and a dark area about the umbilicus. In addition to that there may be a supraperipheral band and a band between the periphery and the base. In some of the specimens the last whorl becomes gradually brown toward the aperture. In such there is usually a zone of the ground color at the periphery.

The type (U.S.N.M. no. 313616) has 5.1 whorls and measures: Length, 30.8 mm; greater diameter, 31.1 mm; lesser diameter, 26.7 mm.

U.S.N.M. no. 255958 contains 17 topotypes, the perfect specimens of which measure:

U.S.N.M. no.	Number of whorls	Length	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
255958	4.8	29.5	33.2	27.7
255958	4.8	28.8	30.9	26.8
255958	5.0	27.1	32.0	26.7
255958	4.6	26.6	31.7	26.5
255958	4.7	26.4	32.4	26.3
255958	4.7	26.4	30.7	25.5
255958	4.7	28.5	32.7	26.7
255958	4.8	29.3	31.9	26.8
255958	4.8	27.1	31.0	26.2
255958	5.0	27.5	28.7	25.2
255958	4.8	27.8	32.8	27.1
255958	4.9	26.5	28.7	24.8
255958	4.6	26.9	30.3	25.2
255958	5.0	26.0	28.8	24.1
255958	4.6	27.7	31.6	26.5
255958	4.7	28.9	34.0	28.0
255958	4.8	27.4	30.3	25.6
Average	4.78	27.55	31.28	26.22
Greatest	5.0	29.5	34.0	28.0
Least	4.6	26.0	28.7	24.1

This race coming from the western shore of Mansalay Bay can easily be distinguished from the others by its pale greenish plum color.

COCHLOSTYLA (CALOCOCHLEA) GERTRUDIS Möllendorff, Kobelt, and Winter

Plate 97, Figures 1–3

1853. *Helix solida* Pfeiffer, Proc. Zool. Soc. London, 1851, p. 263; not *Bulimus solidus* Pfeiffer, Proc. Zool. Soc. London, 1842, p. 152.

1901. *Cochlostyla roissyana solida* Hidalgo, Obras malacologicas, pt. 1, pp. 463–466; in part.

1901. *Cochlostyla roissyana* var. *q* Hidalgo, *ibid.*, p. 466.

1910. *Cochlostyla gertrudis* Möllendorff, Kobelt, and Winter, Semper's Reisen im Archipel der Philippinen, vol. 10, pp. 205–206 (in part), pl. 42, fig. 5.

1932. *Cochlostyla* (*Calocochlea*) *gertrudis* Bartsch, Journ. Washington Acad. Sci. vol. 22, p. 336.

Shell helicoid. The early whorls are buff with a pinkish tinge; the later turns, becoming increasingly darker, finally brown. The ground color, however, when the periostracum is removed, is yellowish olivaceous-buff. The interior of the aperture and columella are white, while the outer lip is tinged with pale brown. Nuclear whorls 1.7, depressed, moderately rounded, and marked by incremental lines, the last half of the last whorl being rather rough. The postnuclear whorls are moderately well rounded, the first one fairly smooth and marked by incremental lines and fine spiral striations. The succeeding turn is marked by obsolete riblike axially slanting threads, which become weaker on the last turn and more closely approximated. These whorls also show microscopic spiral striations. The periphery is feebly angulated; base moderately rounded and marked by threadlike axial riblets and spiral lines. The aperture is broadly oval, oblique; the outer lip is very slightly expanded and reflected; columella broad, somewhat excavated, and oblique.

The specimen described and figured (U.S.N.M. no. 201040) was collected by Quadras at Santa Maliyboy, Bongabon, Mindoro. It has 5 whorls and measures: Length, 28.8 mm; greater diameter, 36.7 mm; lesser diameter, 30.1 mm.

Another specimen (U.S.N.M. no. 255973), from Mansalay Bay, Mindoro, collected by myself, has 4.8 whorls and measures: Length, 25.8 mm; greater diameter, 34.2 mm; lesser diameter, 28.1 mm.

Pfeiffer, in 1843,[11] described *Bulimus solidus* from San Juan, Cagayan, Province of Luzon, which is a *Cochlostyla*. Later, in 1853,[12] he described *Helix solida*, which is likewise a *Cochlostyla*. This second name, therefore, has to be suppressed, and this was done in 1910 by Möllendorff, Kobelt, and Winter [13] who rechristened the shell *Cochlostyla gertrudis*, the name here applied.

In a general way this shell recalls *Cochlostyla roissyana*, but it is more depressed and more helicoid and lacks the dark columellar area so characteristic of that species.

---

[11] Proc. Zool. Soc. London for 1842, p. 152, 1843.

[12] Proc. Zool. Soc. London for 1851, p. 263, 1853.

[13] Semper's Reisen im Archipel der Philippinen, vol. 10, pp. 205–206, 1910.

Subgenus HALOCOCHLEA Bartsch

1932. *Halocochlea* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 336.

In this subgenus the shell is helicoid. The periphery is angulated. The last whorl slopes almost at the same angle posteriorly and basally from the periphery. The outer lip is slightly expanded and reflected, and the columella is very oblique and excavated. There is scarcely any calcareous material in the shell, which is thin and diaphanous.

Type: *Cochlostyla* (*Halocochlea*) *lillianae* Bartsch.

COCHLOSTYLA (HALOCOCHLEA) LILLIANAE Bartsch

PLATE 97, FIGURES 4–6

1932. *Cochlostyla* (*Halocochlea*) *lillianae* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 336.

The shell is exceedingly thin, in fact so thin that by transmitted light one is able to see all the internal structure, including the columella, as plainly as if one were looking through a piece of thin greenish glass. The nuclear whorls are white, and the postnuclear whorls very pale yellowish olive-green. There is a dark chestnut-brown columellar area, which contrasts markedly with the green base and the white of the columellar area. The reflected outer lip is pale green, while the interior of the aperture is pearly gray. There is also a very slender brown thread separated by a space about as wide as a thread from the summit of the turn on the last whorl. Nuclear whorls 2, well rounded, smooth. The postnuclear whorls are somewhat inflated, strongly rounded, marked by fine incremental lines, which have an almost threadlike appearance, and numerous, closely spaced, microscopic spiral striations on both spire and base. The aperture is almost circular; the suture is slightly impressed and the periphery obsoletely angulated. The base is moderately long and strongly rounded.

The type (U.S.N.M. no. 255825), collected by Col. Edgar A. Mearns on Mount Halcon, has 4.2 whorls and measures: Length, 27.7 mm; greater diameter, 28.3 mm; lesser diameter, 23.7 mm.

I have taken great pleasure in naming this species for Miss Lillian Mearns, daughter of the collector. It is one of the most exquisite species known from the Philippine Islands, and the type at the present time constitutes the only known specimen.

Subgenus HELICOSTYLA Férussac

In this subgenus the shell varies from ovate to elongate-ovate. The apex is blunt and the base expanded and usually conspicuously differentiated from the spire by color markings. A thin dehiscent periostracum is present. The outer lip is somewhat expanded and reflected, and the columella slightly excavated.

Type: *Cochlostyla* (*Helicostyla*) *mirabilis* (Férussac).

I am placing two of the Mindoro Province species here, namely, *Cochlostyla* (*Helicostyla*) *fulgens* (Sowerby) and *C.* (*H.*) *dimera* (Jonas).

COCHLOSTYLA (HELICOSTYLA) FULGENS (Sowerby)

Shell varying in shape from broadly ovate to elongate-ovate, imperforate, the spire with a blunt apex. In the various races before me the ground color of the postnuclear whorls is milk-white; that of the nuclear turns in the fresh state is translucent pale horn color. The spire is covered with a thin, scarcely perceptible film of periostracum, while the base is much more provided with this element. In fact, the base appears as if covered with a heavy coat of varnish. The postnuclear whorls are variously banded with chestnut-brown or almost blackish brown; sometimes a combination of these colors is present on the same shell. In most of our specimens there is but a single band on the spire; in some, however, we have a brown zone near the summit and two or three anterior to this. The base is by far the more variably marked portion of the shell. The columellar area is always dark, and in addition to this there may be one, two, or three bands of varying width present, or these bands may become fused to form a completely dark base or there may be a zone or two of light color. The interior of the aperture is white, frequently showing the dark spiral bands of the outside within. These bands appear to belong to the very substance of the shell. The peristome is white. Nuclear whorls about 1.5, forming an almost flattened apex. The succeeding turns are somewhat inflated and strongly rounded. The periphery is well rounded, and the base is rather short, inflated, and well rounded. The postnuclear whorls are marked by retractively curved, fine microscopic lines of growth and microscopic spiral striations.

The aperture is oblique, almost subcircular; the outer lip moderately expanded and reflected. The columella is broad, widest in the middle. The parietal wall is covered by a thin, translucent callus.

This species appears to be confined to the northern and eastern portion of Mindoro. It seems to break up into several races, which may be distinguished by the following key:

KEY TO THE SUBSPECIES OF COCHLOSTYLA (HELICOSTYLA) FULGENS

Base covered by a thick olivaceous-yellow periostracum.
  Shell broadly ovate---fulgens
  Shell elongate-ovate---johnsoni
Base not covered by a thick olivaceous-yellow periostracum.
  Base covered by a thin yellow periostracum---------------------sapolana

COCHLOSTYLA (HELICOSTYLA) FULGENS FULGENS (Sowerby)

PLATE 98, FIGURES 4–12

1841. *Helix fulgens* SOWERBY, Proc. Zool. Soc. London, 1841, p. 3.
1842. *Helix fulgens* PFEIFFER, Symbolae, vol. 2, p. 28.
1848. *Helix fulgens* PFEIFFER, Monographia heliceorum viventium, vol. 1, p. 221.
1849. *Helix fulgens* PFEIFFER, Martini-Chemnitz Conchylien Cabinet, ed. 2, vol. 1, Abt. 12, Theil 1, pp. 287–288, pl. 48, figs. 3, 4.
1850. *Helicostyla fulgens* ALBERS, Die Heliceen, ed. 1, p. 104.
1851. *Helix fulgens* REEVE, Conchologia iconica, pl. 7, figs. 31a, 31b.
1851. *Helix fulgens* DESHAYES, Férussac's Histoire naturelle . . . mollusques . . ., vol. 1, pp.318–319, pl. 108, figs. 1, 2, 9, 10.
1853. *Helix fulgens* PFEIFFER, Monographia heliceorum viventium, vol. 3, p. 172.
1855. *Helicostyla fulgens* H. and A. ADAMS, The genera of recent Mollusca, vol. 2, p. 192.
1856. *Helix* (*Helicostyla*) *fulgens* PFEIFFER, Malakozool. Blätter, vol. 2, p. 145.
1859. *Helix fulgens* PFEIFFER, Monographia heliceorum viventium, vol. 4, p. 206.
1860. *Helicostyla fulgens* MARTENS, Albers, Die Heliceen, ed. 2, p. 175.
1868. *Helix fulgens* PFEIFFER, Monographia heliceorum viventium, vol. 5, p. 274.
1887. *Cochlostyla fulgens* HIDALGO, Journ. Conchyl., vol. 35, p. 145.
1892. *Cochlostyla mirabilis fulgens* PILSBRY, Man. Conch., ser. 2, vol. 7, pp. 182–183.
1895. *Helicostyla mirabilis fulgens* PILSBRY, Man. Conch., ser. 2, vol. 9, p. 224.
1896. *Cochlostyla fulgens* ELERA, Catalogo sistematico de toda la fauna de Filipinas, vol. 3, p. 586.
1897. *Cochlostyla fulgens* HIDALGO, Journ. Conchyl., vol. 44, pp. 258, 284, 331, 341, 351.
1898. *Cochlostyla fulgens* MÖLLENDORFF, Abh. Naturf. Ges. Görlitz, vol. 22, p. 113.
1901. *Cochlostyla fulgens* HIDALGO, Obras malacologicas, pp. 453–455 (in part), pl. 36. fig. 5; pl 50, fig. 5; pl. 95, fig. 1; pl. 132, fig. 6.
1909. *Cochlostyla fulgens* MÖLLENDORFF, KOBELT, and WINTER, Semper's Reisen im Archipel der Philippinen, vol. 10, p. 153, pl. 30, fig. 7.
1932. *Cochlostyla* (*Helicostyla*) *fulgens fulgens* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 336.
1933. *Helicostyla* (*Helicostyla*) *fulgens* CLENCH and ARCHER, Papers Michigan Acad. Sci., Arts, Letters, vol. 17, p. 543.

Shell broadly ovate, rather solid, ground color milk-white, the spire being usually covered with the merest indication of a film of periostracum, while the basal portion is much more strongly provided with this element, which here forms a thick olivaceous-yellow coating. In addition to this there are various spiral bands varying in color from bright chestnut-brown to brownish black. These differ in number both on spire and base. In most instances we have a single broad band, almost median between summit and spire, which begins on an early whorl as a slender bright chestnut-colored line and gradually becomes intensified in coloration until it may be almost black. This band is frequently flanked with a narrower one posterior to it. Sometimes the two are both broad and separated by a mere lighter line; sometimes, too, there is a broad band of brown immediately below the summit of the shell. The base is far more variable in its ornamentation than the spire. It always has the columellar area dark, and in addition some of the specimens before me, apparently from the same locality, may show a single band of brown, while in others two or three bands may be present, and in some instances the entire base may be dark or relieved by a lighter zone. These basal bands vary materially in width and spacing, as well as in color, for some are dark, almost blackish brown, while in others the chestnut element prevails or a mixture of the two may be present. The aperture is bluish white within, which is also the color of the expanded and reflected peristome. Nuclear whorls 1.5, well rounded, smooth. The postnuclear whorls are strongly rounded, appressed at the summit, and marked by slender, retractively slanting, axial lines of growth and also by very fine microscopic spiral striations. This sculpture is present on both spire and base. The aperture is broadly ovate, oblique; the peristome is slightly expanded and reflected, a little broader on the insertion of the inner lip where it is somewhat excavated.

The specimen described and figured (U.S.N.M. no. 255822a) agrees best with the figure published by Pfeiffer in Martini-Chemnitz. It was collected by Col. Edgar A. Mearns on the Mount Halcon Expedition, probably somewhere in the environs of Calapan. It has 5 whorls and measures: Length, 33.9 mm; greater diameter, 28.5 mm.

A series of additional specimens from the same locality yields the following data:

U.S.N.M. no.	Number of whorls	Length	Greater diameter	Lesser diameter	Locality
		Mm	*Mm*	*Mm*	
255822	5. 1	31. 8	31. 4	26. 8	
255822	4. 9	30. 9	31. 4	27. 3	
255822	4. 7	29. 6	29. 3	25. 3	
255822	4. 5	28. 9	31. 0	26. 8	
255822	4. 6	29. 3	29. 8	25. 4	
255822	4. 9	33. 6	29. 9	24. 7	
255822	4. 8	31. 2	29. 4	25. 8	
255822	4. 7	29. 8	29. 4	24. 4	
255822	4. 9	32. 0	30. 9	25. 9	
255822	4. 5	29. 5	28. 7	24. 6	
255822	4. 6	29. 7	29. 8	25. 4	
255822	4. 9	31. 5	28. 8	26. 1	
255822	4. 9	32. 2	29. 8	26. 0	
255822	4. 6	28. 0	29. 7	26. 3	
255822	4. 6	29. 2	29. 5	25. 8	
255822	4. 5	28. 7	29. 9	25. 9	
255822	4. 6	32. 3	31. 4	26. 0	
255838	4. 5	31. 4	33. 2	26. 5	Mindoro or Luzon.
255838	4. 4	28. 2	29. 1	24. 8	
255838	4. 5	31. 7	29. 1	25. 4	
313569	5. 2	36. 6	32. 5	28. 4	Carayrayan, Calapan, Mindoro.
313569	4. 9	34. 1	31. 3	26. 1	
313569	4. 6	30. 0	32. 3	26. 0	
313569	5. 1	32. 9	32. 3	27. 5	
313569	5. 0	32. 2	31. 3	26. 5	
313569	4. 6	30. 5	32. 3	27. 0	

U.S.N.M. no.	Number of whorls	Length	Greater diameter	Lesser diameter	Locality
		Mm	*Mm*	*Mm*	
313569	4. 9	37. 4	32. 3	28. 4	
313569	4. 7	34. 2	32. 5	28. 2	
313569	5. 0	32. 2	32. 1	26. 9	
313569	4. 6	32. 3	31. 8	27. 5	
313569	4. 8	33. 3	28. 9	24. 9	
313569	5. 0	30. 8	30. 1	25. 9	
313569	4. 6	32. 8	32. 2	28. 2	
105268	4. 9	33. 4	31. 0	28. 8	Mindoro.
313570	5. 0	35. 5	28. 6	24. 6	Menage Expedition, northeastern Mindoro.
313570	4. 9	34. 6	28. 9	25. 8	
313570	5. 0	33. 5	27. 5	23. 9	
313570	5. 1	39. 8	33. 0	28. 2	
313570	5. 0	31. 8	27. 1	23. 2	
313570	5. 0	32. 7	28. 9	24. 1	
313570	5. 1	38. 7	31. 3	27. 4	
313570	4. 9	34. 7	30. 0	24. 8	
313570	5. 0	31. 3	28. 5	24. 3	
313570	5. 0	27. 3	31. 8	26. 4	
313570	5. 1	37. 0	28. 4	25. 8	
313570	5. 0	35. 3	29. 4	25. 1	
313570	5. 1	35. 8	31. 1	25. 4	
313570	5. 1	35. 8	29. 8	25. 8	
313570	5. 1	39. 0	29. 2	26. 0	
313570	4. 6	32. 2	30. 2	26. 1	
313570	5. 0	32. 6	28. 8	24. 3	
313570	4. 6	34. 2	29. 1	26. 1	
313570	5. 1	36. 9	30. 3	26. 1	
313570	5. 0	36. 8	30. 7	27. 9	
313570	5. 1	35. 0	28. 3	23. 8	
313570	4. 9	32. 3	30. 3	25. 6	
313570	5. 0	32. 7	27. 8	24. 6	
256166	4. 8	33. 8	28. 7	26. 2	Varadero.
256166	4. 9	32. 4	32. 0	27. 5	
256166	4. 4	27. 7	29. 3	24. 2	
256166	4. 9	31. 4	33. 7	28. 1	
313572	5. 1	32. 6	30. 6	26. 7	Calapan.
313572	5. 0	33. 0	31. 5	29. 9	
313572	5. 0	35. 6	33. 0	29. 2	
313572	4. 8	31. 8	31. 8	26. 9	
313572	4. 8	33. 1	31. 1	27. 6	
313572	4. 8	32. 3	31. 0	26. 5	
313572	5. 0	30. 9	29. 1	25. 2	
313572	4. 6	30. 6	31. 0	26. 4	
20400	4. 7	31. 6	28. 5	25. 4	Exploring Expedition.
255829	4. 9	31. 3	28. 8	25. 5	Mount Halcon.
255829	5. 1	36. 3	30. 0	26. 7	
313571	4. 6	34. 8	32. 3	28. 0	San Teodoro.
313571	4. 8	30. 9	30. 0	26. 0	
313571	5. 0	32. 0	31. 7	27. 5	
Average	4. 84	32. 7	30. 4	26. 19	
Greatest	5. 2	39. 8	33. 7	29. 9	
Least	4. 4	27. 3	27. 1	23. 2	

I have selected for our illustration a series of specimens to show the degree of variation in the color pattern in the shells before me.

COCHLOSTYLA (HELICOSTYLA) FULGENS JOHNSONI Bartsch

PLATE 97, FIGURES 10–12

1891. *Cochlostyla fulgens* HIDALGO, Obras malacológicas, pp. 453–455 (in part), pl. 50, fig. 4.

1932. *Cochlostyla* (*Helicostyla*) *fulgens johnsoni* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 336.

Shell elongate-ovate. Nuclear whorls pale brown, the succeeding whorls milk-white, banded with bright chestnut-brown and almost blackish-brown spiral zones. The spaces between the dark zones on the base are buffish yellow. The interior of the aperture is bluish white, which is also the color of the peristome and the inner lip. Nuclear whorls 2, well rounded, forming a depressed spire. The postnuclear whorls are inflated, appressed at the summit, and marked by very fine retractively curved lines of growth and microscopic spiral striations both on spire and base. The aperture is almost circular, oblique; the peristome is slightly expanded and reflected, and the columella is slightly excavated. The parietal wall is covered by a thin callus.

The type (U.S.N.M. no. 314080) was collected by Mr. Quadras at Sitio Pamulon, Mansalay Bay, Mindoro. It has 5.5 whorls and measures: Length, 41 mm; greater diameter, 30.4 mm; lesser diameter, 27.4 mm.

Another specimen (U.S.N.M. no. 20399), obtained by the Exploring Expedition, which I am referring here and which bears no locality label, has 5.4 whorls and measures: Length, 37.5 mm; greater diameter, 28 mm; lesser diameter, 26.3 mm.

In addition to this there are two young specimens (U.S.N.M. no. 7589), also collected by the Exploring Expedition, and four young specimens (U.S.N.M. no. 255818) collected by myself on a hill on the western shore of Mansalay Bay. This race is readily distinguished from the other two by its more elevated spire. It has the dark base and variable bands of the typical race.

COCHLOSTYLA (HELICOSTYLA) FULGENS SAPOLANA Bartsch

PLATE 98, FIGURES 1–3

1932. *Cochlostyla* (*Helicostyla*) *fulgens sapolana* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 336.

1933. *Helicostyla* (*Helicostyla*) *fulgens* CLENCH and ARCHER, Papers Michigan Acad. Sci., Arts, and Letters, vol. 17, p. 543; in part.

Shell broadly ovate. Nuclear whorls pale horn color; postnuclear whorls white, the first with a median brown band, which on the last whorl is almost black. A similar dark band is at the periphery and two on the base. The columellar area is likewise almost black. The spaces separating these bands on the base are pale straw yellow.

The interior of the aperture is white, showing the dark bands within. The peristome is white. Nuclear whorls 2, well rounded, forming an almost flat apex. The postnuclear whorls are inflated and strongly rounded, marked by retractively curved lines of growth, which extend to the umbilicus on the last whorl, and by fine microscopic spiral striations, which are present on spire and base. The aperture is almost circular, oblique. The peristome is slightly expanded and reflected, somewhat excavated on the columellar side. The parietal wall is covered by a thin callus.

The type (U.S.N.M. no. 313574) was collected by Pedro de Mesa on Mount Sapol near Calapan, Mindoro. It has 4.9 whorls and measures: Length, 30.8 mm; greater diameter, 31.8 mm; lesser diameter, 27.8 mm.

Five topotypes (U.S.N.M. no. 313573), from the same source, yield the following measurements:

Number of whorls	Length	Greater diameter	Lesser diameter
	Mm	*Mm*	*Mm*
4.7	32. 8	31. 1	28. 0
4.6	31. 4	29. 2	26. 0
4.9	34. 3	31. 0	27. 3
4.7	33. 8	31. 4	27. 8
4.3	27. 8	30. 1	25. 0

The last specimen received a bad injury in the early state of its development, which may be responsible for its dwarfing.

Two of the specimens before me have only two basal bands plus the dark columellar area.

This race is distinguished from typical *fulgens* in lacking the dark olivaceous-yellow base. Here the base is only a trifle more yellowish than the spire.

COCHLOSTYLA (HELICOSTYLA) DIMERA (Jonas)

Plate 97, Figures 7–9

1846. *Helix dimera* Jonas, Abh. Naturw. Ver. Hamburg, vol. 1, p. 123, pl. 11, figs. 19, 19a.
1846. *Helix jonasi* var. β, Pfeiffer, Proc. Zool. Soc. London, 1845, p. 126.
1848. *Helix dimera* Pfeiffer, Monographia heliceorum viventium, vol. 1, p. 226.
1850. *Helix dimera* Pfeiffer, Martini-Chemnitz Conchylien Cabinet, ed. 2, vol. 1, Abt. 12, Theil 2, p. 299.
1850. *Helicostyla dimera* Albers, Die Heliceen, ed. 1, p. 104.
1851. *Helix dimera* Reeve, Conchologia iconica, pl. 16, fig. 61.
1853. *Helix dimera* Pfeiffer, Monographia heliceorum viventium, vol. 3, p. 172.
1855. *Helicostyla dimera* H. and A. Adams, The genera of recent Mollusca, vol. 2, p. 191.
1856. *Helicostyla dimera* Pfeiffer, Malakozool. Blätter, vol. 2, p. 145.

1859. *Helicostyla dimera* PFEIFFER, Monographia heliceorum viventium, vol. 4, p. 198.
1860. *Helicostyla dimera* MARTENS, Albers, Die Heliceen, ed. 2, p. 175.
1868. *Helix dimera* PFEIFFER, Monographia heliceorum viventium, vol. 5, p. 267.
1877. *Cochlostyla dimera* SEMPER, Reisen im Archipel der Philippinen, pt. 2, vol. 3, p. 187.
1887. *Cochlostyla dimera* HIDALGO, Journ. Conchyl., vol. 35, p. 141.
1892. *Cochlostyla dimera* PILSBRY, Man. Conch., ser. 2, vol. 7, p. 156, pl. 30, figs. 29, 30.
1895. *Helicostyla dimera* PILSBRY, Man. Conch., ser. 2, vol. 9, p. 223.
1897. *Helix dimera* HIDALGO, Journ. Conchyl., vol. 44, pp. 245, 279, 290, 331, 332, 340, 349, 351.
1898. *Cochlostyla dimera* MÖLLENDORFF, Abh. Naturf. Ges. Görlitz, vol. 22, p. 122; in part.
1901. *Cochlostyla dimera* HIDALGO, Obras malacologicas, pt. 1, pp. 481–482 (in part), pl. 48, fig. 8.
1910. *Helix dimera* MÖLLENDORFF, KOBELT, and WINTER, Semper's Reisen im Archipel der Philippinen, vol. 10, pp. 203–204 (in part), pl. 41, figs. 4, 4a, 5.
1932. *Cochlostyla* (*Helicostyla*) *dimera* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 336.

Shell broadly ovate, covered with a very thin pale olive-yellow periostracum, which is usually absent on the early turns. When the periostracum is removed the nuclear whorls are brown, while the succeeding turns are also brown but gradually become paler, passing through a rosy tinge to white. A moderately dark brown band is present at the summit and another immediately posterior to the periphery with the space between flesh-colored. This color scheme terminates abruptly at the periphery of the last whorl, from there anteriorly to the umbilical area. The broad base is chocolate-brown, which is also the color of the outer lip, while the columella is flesh-color except at the extreme tip, which is chocolate-brown. The interior of the aperture is divided in its color scheme between bluish white posteriorly and chocolate-brown basally. The 1.6 nuclear whorls are moderately elevated, well rounded, and marked by incremental lines only. The postnuclear whorls are moderately well rounded and marked by fine, retractively slanting, incremental lines, which are almost threadlike, and numerous microscopic spiral striations on both spire and base. The aperture is almost subcircular, oblique; outer lip slightly expanded and reflected. The columella is excavated and spreads over the base as a whitish callus.

The specimen described and figured (U.S.N.M. no. 313617), collected by Quadras on Mindoro, has 5.2 whorls and measures: Length, 29.9 mm; greater diameter, 26.3 mm; lesser diameter, 23.4 mm.

A series of the specimens in our collection yields the following measurements:

U.S.N.M. no.	Number of whorls	Length	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
90345	5. 0	27. 3	27. 7	23. 4
103947	5. 0	28. 2	26. 4	23. 6
103947	5. 2	30. 6	27. 7	23. 6
103947	5. 3	32. 2	27. 1	24. 9
309463	5. 1	29. 8	27. 5	24. 3
309463	4. 9	30. 5	30. 2	25. 4
315709	5. 0	32. 4	33. 2	27. 4
315709	4. 9	28. 2	28. 4	24. 4
315708	4. 4	25. 2	26. 4	22. 8
Average	4. 98	29. 38	28. 29	24. 42
Greatest	5. 3	32. 4	33. 2	27. 4
Least	4. 4	25. 2	26. 4	22. 8

Subgenus COCHLOSTYLA Férussac

In this subgenus the shell varies from ovate to elongate-ovate. The apex is blunt and the aperture broadly oval to subcircular. The peristome is slightly expanded and reflected, while the columella is somewhat excavated. The periphery may be rounded or show the merest suggestion of angulation. The surface is covered with a rather strong periostracum, which shows axial hydrophanous zones that usually extend to the umbilical area. The shells may be unicolor or variously spirally banded.

Type: *Cochlostyla* (*Cochlostyla*) *metaformis* (Férussac).

Only one species from Mindoro Province belonging here is known: *Cochlostyla* (*Cochlostyla*) *hydrophana* (Sowerby).

COCHLOSTYLA (COCHLOSTYLA) HYDROPHANA (Sowerby)

Shell ovate or elongate-ovate, covered by a thin hydrophanous periostracum, which is frequently denuded on the early whorls. The nuclear whorls and the early postnuclear turns are white. There is a brown band immediately below the summit and another one at the periphery. These vary in width in different individuals. There is also a median band on the base and a dark columellar area. These bands may be all of the same color, or the peripheral one may be a little lighter than the rest. As a rule they are dark chocolate-brown. The interior of the aperture is bluish white, and so is the peristome. Nuclear whorls 2, well rounded and marked by incremental lines only, except on the last portion of the last whorl, where fine spiral striations are indicated. The postnuclear whorls are strongly rounded, appressed at the summit, and marked by retractively slanting incremental lines and exceedingly closely spaced microscopic spiral striations on both spire and base. The periphery of the last whorl is well rounded, and the base is somewhat inflated and strongly rounded. The aperture is subcircular, the outer lip being moderately expanded and reflected, while the columella has a twist that gives it almost the appearance of having a tooth a little nearer to its base than its insertion.

Sowerby described this species from the Cuming collection, and he cites Puerto Galera, Island of Mindoro, as the type locality. I collected specimens on Medio Island, which is in Puerto Galera, that in every way correspond with Sowerby's form, and I am inclined to believe that his shell came from Medio Island. On the other hand, the shells that I collected to the east of the peninsula on which Puerto Galera is located, namely, Varadero Bay, yielded a much more elevated form, to which I have given the subspecific name *varaderoana*. The two races may be distinguished by the following key:

KEY TO THE SUBSPECIES OF COCHLOSTYLA (COCHLOSTYLA) HYDROPHANA

Shell decidedly elevated	varaderoana
Shell not decidedly elevated	hydrophana

COCHLOSTYLA (COCHLOSTYLA) HYDROPHANA VARADEROANA Bartsch

PLATE 99, FIGURE 3

1932. *Cochlostyla* (*Cochlostyla*) *hydrophana veroderoana* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 336.

Shell elongate-ovate. The nuclear whorls and the first postnuclear whorls white; the later ones with a very narrow light zone at the summit followed by a darker band immediately below the summit, which sometimes is pale, at other times quite dark chocolate-brown. There is also a brown band immediately posterior to the periphery and another on the middle of the base, and a conspicuous dark columellar area. These are all separated by brown zones of flesh-color in the decorticated specimens, or where the periostracum is present by an olivaceous or olivaceous-waxy color band. The interior of the aperture and peristome are white.

The type (U.S.N.M. no. 313619) was collected by me at Varadero, Mindoro. It has 5.1 whorls and measures: Length, 36.8 mm; greater diameter, 28.7 mm; lesser diameter, 26.0 mm.

Seven topotypes (U.S.N.M. no. 256166) yield the following measurements:

Number of whorls	Length	Greater diameter	Lesser diameter
	Mm	*Mm*	*Mm*
5. 1	33. 2	27. 5	24. 3
5. 5	37. 0	28. 0	25. 8
5. 2	37. 3	28. 3	25. 3
5. 3	36. 4	28. 2	25. 3
5. 5	36. 4	28. 2	25. 0
5. 5	37. 0	28. 3	25. 8
5. 2	34. 8	26. 8	24. 3

COCHLOSTYLA (COCHLOSTYLA) HYDROPHANA HYDROPHANA (Sowerby)

Plate 99, Figure 1

1841. *Helix* (*Cochlogena*) *hydrophana* Sowerby, Proc. Zool. Soc. London, 1840, p. 88.
1842. *Bulimus hydrophana* Pfeiffer, Symbolae, vol. 2, p. 46.
1848. *Helix hydrophana* Pfeiffer, Monographia heliceorum viventium, vol. 1, p. 222.
1848. *Bulimus hydrophana* Reeve, Conchologia iconica, pl. 17, fig. 69.
1850. *Helix hydrophana* Pfeiffer, Martini-Chemnitz Conchylien Cabinet, ed. 2, vol. 1, Abt. 12, Theil 2, pp. 290–291, pl. 49, figs. 8, 9.
1850. *Bulimus* (*Orthostylus*) *hydrophana* Albers, Die Heliceen, ed. 1, p. 136.
1853. *Bulimus hydrophanus* Pfeiffer, Monographia heliceorum viventium, vol. 3, p. 397.
1859. *Bulimus hydrophanus* Pfeiffer, Monographia heliceorum viventium, vol. 4, p. 358.
1860. *Cochlodryas hydrophanus* Martens, Albers, Die Heliceen, ed. 2, p. 176.
1868. *Bulimus hydrophanus* Pfeiffer, Monographia heliceorum viventium, vol. 6, p. 6.
1869. *Helicostyla hydrophana* Frauenfeld, Verh. Zool. Bot. Ver. Wien, vol. 19, p. 875.
1877. *Helicostyla hydrophana* Pfeiffer, Monographia heliceorum viventium, vol. 8, p. 7; in part.
1887. *Cochlostyla hydrophana* Hidalgo, Journ. Conchyl., vol. 35, p. 148.
1892. *Cochlostyla hydrophana* Pilsbry, Man. Conch., ser. 2, vol. 7, p. 187, pl. 36, figs. 35–37.
1895. *Helicostyla hydrophana* Pilsbry, Man. Conch., ser. 2, vol. 9, p. 225.
1896. *Helicostyla hydrophana* Elera, Catalogo sistematico de toda la fauna de Filipinas, vol. 3, p. 587.
1897. *Cochlostyla hydrophana* Hidalgo, Journ. Conchyl., vol. 44, pp. 288, 331, 335, 338, 339, 341, 350.
1898. *Cochlostyla metaformis* Möllendorff, Abh. Naturf. Ges. Görlitz, vol. 22, p. 124; in part.
1901. *Cochlostyla metaformis hydrophana* Hidalgo, Obras malacologicas, p. 432, pl. 77, figs. 2, 3; pl. 108, figs. 6, 7.
1910. *Cochlostyla* (*Dryocochlias*) *metaformis*, Möllendorff, Kobelt, and Winter, Semper's Reisen im Archipel der Philippinen, vol. 10, pp. 213–215.
1932. *Cochlostyla* (*Cochlostyla*) *hydrophana hydrophana* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 336.

Shell broadly ovate, covered with a thin hydrophanous periostracum. Nuclear whorls 2, well rounded, forming a flattish apex. The postnuclear whorls are inflated, strongly rounded, and marked with a narrow light zone edging the summit, succeeded by a broad chocolate-brown band, which in turn is followed by a still broader flesh-colored zone that is succeeded by a band of brown equaling in intensity of color and width that adjacent to the summit, which terminates anteriorly at the periphery. Adjacent to this the base bears a flesh-colored zone, equaling the median one on the spire, and a median chocolate-brown band equaling the supraperipheral band. There is also a broad chocolate-brown area about the umbilicus, and the space between it and the median basal band is flesh-color. The anterior of the aperture is bluish white, which is also the color of the somewhat expanded outer lip and columella.

A series of specimens, mostly young and imperfect, was collected by me on Medio Island, Puerto Galera, during the *Albatross* Expedition to the Philippines.

The specimen described and figured (U.S.N.M. no. 255908) has 5 whorls and measures: Length, 32.6 mm; greater diameter, 28.6 mm; lesser diameter, 24.7 mm.

Two additional individuals under the same registry, from the same source, have each 5 whorls. They measure: Length, 32.4 and 35.7 mm; greater diameter, 27.4 and 29.3 mm; lesser diameter, 23.3 and 25.5 mm, respectively.

This race differs from *Cochlostyla* (*Cochlostyla*) *hydrophana varaderoana* in being broadly ovate.

Subgenus COCHLODRYAS Martens

In this subgenus the shell is subglobular, sometimes a little more depressed and sometimes a little more elevated. The periostracum is very thin, usually a mere film, and frequently absent, being easily worn off. All the species are marked with green. The shell may be unicolor or banded with spiral zones of green or brown or a combination of these. A columellar dark patch may or may not be present. A narrow white thread is present at the summit. The aperture varies from subcircular to subquadrate.

Type: *Cochlostyla* (*Cochlodryas*) *polychroa* (Sowerby).

COCHLOSTYLA (COCHLODRYAS) FLORIDA (Broderip)

The shell is broadly ovate and rather flat, with a blunt apex. The surface is covered by a thin dull periostracum, which is usually some shade of green or olive, though in some forms brown or pale olivaceous-waxy. The early whorls may be white or brown, and the ground color of the succeeding turns, when the periostracum is removed, is white. The shell may be unicolor on its exterior or it may have spiral bands. There may be a zone below the summit, another at the periphery, and one between the two, and there is usually a dark area about the columella though in *Cochlostyla* (*Cochlodryas*) *helicoides* this element is missing. Any one of the brown bands may disappear. In addition to these brown bands, there is always a narrow white zone at the summit immediately above the first brown band. The interior of the aperture and the peristome are white. This species, as far as known, appears to be confined to eastern Mindoro and breaks up into a series of races, which are here defined.

KEY TO THE SUBSPECIES OF COCHLOSTYLA (COCHLODRYAS) FLORIDA

Columellar area of base dark.
  Periostracum leaf green ---------- **florida**
  Periostracum not leaf green.
    Periostracum olivaceous-brown ---------- **fuscolabiata**
    Periostracum not olivaceous-brown.
      Periostracum golden-yellow ---------- **aureola**
      Periostracum not golden-yellow.
        Periostracum olivaceous waxy yellow ---------- **signa**
Columellar area not dark ---------- **helicoides**

COCHLOSTYLA (COCHLODRYAS) FLORIDA FLORIDA (Broderip)

PLATE 99, FIGURE 12

1841. *Helix* (*Cochlogena*) *florida* BRODERIP, Proc. Zool. Soc. London, 1840, pp. 87–88.
1842. *Helix florida* REEVE, Conchologia systematica, vol. 2, p. 69, pl. 153, fig. 2.
1842. *Bulimus florida* PFEIFFER, Symbolae, vol. 2, p. 47.
1848. *Helix florida* PFEIFFER, Monographia heliceorum viventium, vol. 1, p. 222.
1849. *Bulimus florida* PFEIFFER, Zeitschr. Malak., vol. 6, p. 86.
1850. *Helix florida* PFEIFFER, Martini-Chemnitz Conchylien Cabinet, ed. 2, vol. 1, Abt. 12, Theil 1, p. 295, pl. 50, figs. 1, 2.
1850. *Orthostylus floridus* ALBERS, Die Heliceen, ed. 1, p. 136.
1851. *Helix floridus* REEVE, Conchologia iconica, pl. 11, fig. 43b.
1851. *Helix florida* DESHAYES, Férussac's Histoire naturelle . . . mollusques . . ., vol. 1, pp. 307–308 (in part), pl. 104A, figs. 9–10.
1853. *Bulimus florida* PFEIFFER, Monographia heliceorum viventium, vol. 3, p. 297.
1855. *Helicostyla florida* H. and A. ADAMS, The genera of recent Mollusca, vol. 2, p. 192.
1856. *Bulimus florida* PFEIFFER, Malakozool. Blätter, vol. 2, p. 146.
1859. *Bulimus florida* PFEIFFER, Monographia heliceorum viventium, vol. 4, p. 359.
1860. *Cochlodryas floridus* MARTENS, Albers, Die Heliceen, ed. 2, p. 176.
1868. *Bulimus floridus* PFEIFFER, Monographia heliceorum viventium, vol. 6, p. 6.
1876. *Bulimus floridus* PFEIFFER, Monographia heliceorum viventium, vol. 7, p. 7; in part.
1887. *Cochlostyla florida* HIDALGO, Journ. Conchyl., vol. 35, pp. 151–152; in part.
1891. *Cochlostyla florida* PILSBRY, Man. Conch., ser. 2, vol. 6, pp. 177–178 (in part), pl. 38, figs. 71–73.
1895. *Helicostyla florida* PILSBRY, Man. Conch., ser. 2, vol. 9, p. 225; in part.
1896. *Cochlostyla florida* ELERA, Catalogo sistematico de toda la fauna de Filipinas, vol. 3, p. 584; in part.
1897. *Cochlostyla florida* HIDALGO, Journ. Conchyl., vol. 44, pp. 251, 284, 287, 331, 341, 347, 348, 351, 352.
1898. *Cochlostyla florida* MÖLLENDORFF, Abh. Naturf. Ges. Görlitz, vol. 22, p. 131; in part.
1901. *Cochlostyla florida* HIDALGO, Obras malacologicas, pp. 455–456 (in part), pl. 39, figs. 4–8.
1911. *Cochlostyla florida* MÖLLENDORFF, KOBELT, and WINTER, Semper's Reisen im Archipel der Philippinen, vol. 10, pp. 248–249, pl. 51, figs. 1, 1a, 2; in part.

1932. *Cochlostyla* (*Cochlodryas*) *florida florida* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 336.

Shell ovate, the last turn with a bright grass-green periostracum, which gradually grows paler posteriorly and eventually passes into the flesh-colored apex. In typically colored specimens there is a narrow white thread at the summit followed by a brown band immediately adjacent to this. There is also a brown spiral band of about equal width at the periphery and another between the two. The columellar area is surrounded by a bright chestnut-brown patch. The interior of the aperture and peristome are white. The nucleus consists of 1.8 turns, which are smooth, barring incremental lines and indications of fine spiral striations on the last turn. The nuclear turns and the first postnuclear turns form a blunt apex. The postnuclear whorls are somewhat inflated, strongly rounded, appressed at the summit, and marked by feebly retractively curved lines of growth and very fine spiral striations on both spire and base. The periphery of the last turn is well rounded. The base is short, somewhat inflated, well rounded. The aperture is oblique, broadly oval. The peristome is somewhat expanded and reflected and slightly thickened. The columella is oblique, slightly excavated.

The specimen described and figured (U.S.N.M. no. 313605) was collected by Quadras at Baco in northeastern Mindoro. It has 5.2 whorls and measures: Length, 36.2 mm; greater diameter, 27.6 mm; lesser diameter, 24.5 mm.

A series of specimens (U.S.N.M. no. 313603), collected by the Menage Expedition in northeastern Mindoro, collector's no. 45, yields the following measurements:

U.S.N.M. no.	Number of whorls	Length	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
313603	5. 5	31. 4	28. 7	24. 7
313603	5. 1	33. 2	25. 5	23. 6
313603	5. 5	35. 7	28. 2	25. 5
313603	5. 4	32. 5	27. 4	24. 5
313603	5. 4	31. 0	28. 5	25. 5
313603	5. 1	31. 9	27. 0	34. 2
313603	5. 2	33. 3	26. 4	23. 0
313603	5. 5	35. 6	27. 6	25. 3
313603	5. 5	36. 3	29. 9	26. 4
313603	5. 1	30. 7	27. 2	23. 8
313603	5. 3	32. 3	28. 3	25. 5
313603	5. 5	30. 7	25. 0	32. 0
313603	5. 2	30. 1	25. 8	23. 9
313603	5. 4	33. 0	25. 9	24. 0
313603	5. 5	36. 7	26. 1	22. 9
313603	5. 5	38. 0	28. 4	25. 9
313603	5. 5	32. 5	26. 8	24. 0
313603	5. 6	33. 2	27. 8	25. 1
313603	5. 5	33. 9	27. 3	24. 9
313603	5. 8	36. 8	26. 9	24. 2
313603	5. 6	35. 5	26. 8	24. 7
313603	5. 5	33. 2	26. 0	24. 2

U.S.N.M. no.	Number of whorls	Length	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
313603	5. 3	30. 2	25. 8	23. 6
313603	5. 3	33. 4	29. 0	25. 2
130844	5. 3	33. 2	27. 1	24. 8
104383	5. 6	34. 8	27. 5	24. 9
104383	5. 0	31. 0	28. 5	24. 8
104383	5. 4	34. 1	28. 2	25. 5
1273	5. 5	34. 5	28. 1	25. 2
195437a	5. 3	30. 2	26. 0	22. 8
195437a	4. 6	26. 9	25. 0	22. 2
313604	5. 0	31. 5	25. 8	23. 0
Average	5. 36	33. 04	27. 14	24. 99
Greatest	5. 8	38. 0	29. 9	34. 2
Least	4. 6	26. 9	25. 0	22. 2

This race varies somewhat in color pattern. All of them have a dark band near the summit and the columellar dark area. In some of the others the peripheral zone varies considerably in width and in some specimens extends over the posterior half of the turn.

COCHLOSTYLA (COCHLODRYAS) FLORIDA FUSCOLABIATA Möllendorff, Kobelt, and Winter

Plate 99, Figure 10

1851. *Helix floridus* Reeve, Conchologia iconica, pl. 11, fig. 43c.

1911. *Cochlostyla florida fuscolabiata* Möllendorff, Kobelt, and Winter, Semper's Reisen im Archipel der Philippinen, vol. 10, pp. 248–249 (in part), pl. 51, fig. 3.

1932. *Cochlostyla* (*Cochlodryas*) *florida fuscolabiata* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 336.

Möllendorff, Kobelt, and Winter, as cited above, described a dark olivaceous-brown shell under the above designation. I am not certain as to whether this is merely a color form that may occur in any of the races or whether it is a distinct subspecies. I have but a single specimen before me collected by Quadras (U.S.N.M. no. 313609) that is referable here. This has the light nuclear turns. The postnuclear whorls begin by having the anterior half pale brown, the brown gradually becoming intensified in color. There is a subsummit brown band, which becomes feeble on the last whorl, and there is also a dark columellar area. The space between is olivaceous-brown marked by axial streaks of more intense pigmentation, giving the shell an almost varicid appearance. The light zone at the summit is unusually broad in this specimen. The interior of the aperture has also the merest indication of a brownish wash over the white, and the outer edge of the peristome is tinged with brown.

The specimen has 5.1 whorls and measures: Length, 35.6 mm; greater diameter, 30.3 mm; lesser diameter, 26.3 mm. It bears Quadras' collector's no. 2109 and is labeled "Mindoro" without specific locality.

COCHLOSTYLA (COCHLODRYAS) FLORIDA AUREOLA Bartsch

Plate 99, Figure 11

1932. *Cochlostyla* (*Cochlodryas*) *florida aureola* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 337.

Shell ovate, covered with a rather thick golden-yellow periostracum on the last turn. This color gradually becomes paler posteriorly and eventually merges into white on the first nuclear and postnuclear turns. The usual light thread is present at the summit of the whorls and is followed by a moderately broad dark chestnut-brown band. The dark columellar area is also present. The base is slightly darker than the portion between the periphery and the summit. The interior of the aperture and the peristome are bluish white. Nuclear whorls 1.7, well rounded, smooth except for incremental lines and fine microscopic spiral striations on the last portion of the last turn. The postnuclear turns are somewhat inflated, well rounded, appressed at the summit, and marked by inconspicuous incremental lines and closely spaced microscopic spiral striations, which are present on both spire and base. The aperture is broadly oval, almost circular; the peristome is expanded and reflected and the columella is slightly excavated.

The type (U.S.N.M. no. 313610) is one of three specimens obtained by the Exploring Expedition, probably at the southern tip of Mindoro. It has 5.4 whorls and measures: Length, 34.7 mm; greater diameter, 26.8 mm; lesser diameter, 23.9 mm.

The two additional specimens (U.S.N.M. no. 7617) yield the following measurements: Number of whorls, 5.6 and 5.4; length, 34.1 and 32.4 mm; greater diameter, 26.5 and 25.9 mm; lesser diameter, 23.2 and 23.3 mm, respectively. In shape this race reminds one of *Cochlostyla* (*Cochlodryas*) *florida signa* but can at once be distinguished from it by its heavier shell and entirely different coloration.

COCHLOSTYLA (COCHLODRYAS) FLORIDA SIGNA Bartsch

Plate 99, Figure 2

1932. *Cochlostyla* (*Cochlodryas*) *florida signa* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 337.

The shell is very regularly ovate and very thin. The early whorls are white, the later turns covered with an olivaceous-waxy periostracum. There is a light narrow thread at the summit followed by a narrow bright chestnut-brown band. The columellar area is also bordered by a narrow bright chestnut-colored zone. The interior of the aperture is bluish white, which is also the color of the peristome, while the columella is white plus a dark spot at its junction with the basal lip. Nuclear whorls 1.6, marked by lines of growth and on the last portion by indications of fine spiral lines. The postnuclear whorls are well rounded, somewhat inflated, and marked by retractively curved lines of growth and microscopic spiral striations on both spire and base. The periphery is well rounded. The base is somewhat inflated and strongly rounded. The aperture is almost circular, oblique. The peristome is moderately expanded and reflected. The columella is rather narrow and excavated.

The type (U.S.N.M. no. 313611) was collected by me on the hill on the west shore of Mansalay Bay, Mindoro. It has 5.4 whorls and measures: Length, 31.8 mm; greater diameter, 24.3 mm; lesser diameter, 21.9 mm.

A series of topotypes yields the following additional measurements:

U.S.N.M.no.	Number of whorls	Length	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
255895	5. 2	30. 1	23. 6	22. 2
255895	5. 6	30. 7	24. 9	22. 4
255895	5. 3	30. 8	25. 1	23. 5
255895	5. 0	30. 7	26. 0	23. 5
255895	4. 8	27. 4	25. 9	23. 4
255895	5. 5	28. 4	31. 9	21. 0
255895	5. 6	32. 7	26. 4	23. 6
255895	5. 2	30. 0	24. 9	23. 0
255895	5. 4	29. 3	24. 6	22. 7
255895	5. 2	29. 1	26. 0	23. 2
255895	5. 6	30. 5	23. 2	21. 7
255958	5. 5	31. 4	24. 1	22. 2
255778	5. 1	30. 7	26. 4	23. 4
255778	5. 2	31. 5	27. 4	25. 1
255778	5. 6	38. 0	30. 8	27. 3
255778	5. 7	34. 8	27. 4	24. 3
Average	5. 3	31. 0	26. 16	23. 3
Greatest	5. 7	38. 0	31. 9	27. 3
Least	4. 8	27. 4	23. 2	21. 0

Two of the specimens have also a peripheral band, and one has a band between that of the summit and the periphery.

This race is distinguished from all the others by its exceedingly thin shell and the curious pale coloration of the periostracum, which is of an olivaceous-waxy color.

In this as in other species I collected in Mansalay Bay we find a distinction between those obtained on the west shore and those on the east shore, the differentiation being a parallel one in all the instances.

COCHLOSTYLA (COCHLODRYAS) FLORIDA HELICOIDES (Pfeiffer)

PLATE 99, FIGURE 4

1841. *Helix* (*Cochlogena*) *florida* var. *a* BRODERIP, Proc. Zool. Soc. London, 1840, pp. 87–88.
1851. *Helix floridus* REEVE, Conchologia iconica, pl. 11, fig. 43a.
1851. *Helix florida* DESHAYES, Férussac's Histoire naturelle . . . mollusques . . ., vol. 1, pp. 307–308 (in part), pl. 104A, fig. 11.
1853. *Bulimus helicoides* PFEIFFER, Monographia heliceorum viventium, vol. 3, p. 298.
1855. *Bulimus helicoides* PFEIFFER, Martini-Chemnitz Conchylien Cabinet, ed. 2, vol. 1, Abt. 13, Theil 1, pp. 119–120, pl. 36, figs. 7, 8.
1868. *Bulimus helicoides* PFEIFFER, Monographia heliceorum viventium, vol. 6, p. 524.
1876. *Bulimus floridus* PFEIFFER, Monographia heliceorum viventium, vol. 7, p. 7; in part.
1887. *Cochlostyla florida helicoides* HIDALGO, Journ. Conchyl., vol. 35, p. 152.
1890. *Cochlostyla florida* PILSBRY, Man. Conch., ser. 2, vol. 6, pp. 177–178 (in part), pl. 38, fig. 70.
1895. *Helicostyla florida* PILSBRY, Man. Conch., ser. 2, vol. 9, p. 225; in part.
1896. *Cochlostyla florida* ELERA, Catalogo sistematico de toda la fauna de Filipinas, vol. 3, p. 584; in part.
1897. *Cochlostyla helicoides* HIDALGO, Journ. Conchyl., vol. 44, pp. 251, 253, 284, 287.
1898. *Cochlostyla florida* MÖLLENDORF, Abh. Naturf. Ges. Görlitz, vol. 22, p. 131; in part.
1901. *Cochlostyla florida* HIDALGO, Obras malacologicas, pp. 455–457 (in part), pl. 39, figs. 2, 3.
1911. *Cochlostyla florida* MÖLLENDORFF, KOBELT, and WINTER, Semper's Reisen im Archipel der Philippinen, vol. 10, pp. 248–249 (in part), pl. 51, figs. 4, 4a.
1932. *Cochlostyla* (*Cochlodryas*) *florida helicoides* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 337.

The shell is broadly ovate. The periostracum, where present, is bright olive-green. There are no spiral brown bands, nor is there a dark columellar area apparent in any of the specimens before me. The light zone at the summit is present, and the aperture and peristome are white. The early whorls and nucleus are usually denuded of periostracum and are also white. Nuclear whorls 2, well rounded and marked by incremental lines only. The postnuclear whorls are somewhat inflated, appressed at the summit, well rounded, and marked by retractively curved lines of growth and microscopic spiral striations, which are present on both spire and base. The aperture is broadly obliquely oval; the peristome is moderately expanded and reflected; the columella is somewhat excised.

The specimen described and figured (U.S.N.M. no. 313606a) has 5.3 whorls and measures: Length, 30 mm; greater diameter, 26.4 mm; lesser diameter, 23.3 mm.

A series of additional specimens yields the following measurements:

U.S.N.M. no.	Number of whorls	Length	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
313606	5. 1	32. 0	27. 9	25. 3
313606	5. 4	34. 0	26. 7	24. 3
313606	5. 3	33. 2	27. 3	24. 4
313606	5. 5	34. 5	26. 0	24. 1
313606	5. 0	31. 3	27. 0	24. 2
313606	5. 1	30. 7	26. 5	23. 8
313606	5. 5	35. 2	27. 4	25. 1
313606	5. 0	29. 2	26. 2	23. 0
313606	5. 0	27. 4	24. 0	22. 1
313606	5. 1	30. 3	27. 3	24. 8
313606	5. 0	26. 6	25. 9	22. 9
313606	5. 5	38. 2	28. 5	26. 0
313606	5. 1	29. 3	26. 5	23. 3
313606	5. 6	35. 6	27. 6	25. 4
313606	5. 4	32. 4	27. 9	24. 9
313606	5. 8	35. 8	27. 9	24. 5
313606	5. 2	31. 6	27. 1	24. 0
313606	5. 2	31. 5	26. 1	23. 6
313606	5. 1	30. 8	26. 7	23. 7
313606	5. 2	31. 0	25. 2	22. 6
313606	5. 4	32. 5	25. 3	23. 6
313606	5. 2	33. 6	29. 8	25. 8
313606	4. 9	29. 0	26. 6	23. 9
313606	5. 5	34. 9	28. 0	24. 3
313606	5. 1	32. 4	27. 8	23. 5
313606	5. 5	35. 3	28. 8	25. 4
313606	5. 3	31. 7	28. 2	25. 0
313606	5. 4	34. 5	28. 8	24. 8
313606	5. 5	33. 9	25. 7	23. 7
313606	5. 2	32. 5	29. 0	25. 4
313606	5. 5	33. 6	28. 3	25. 0
313606	5. 4	31. 5	26. 5	23. 4
313606	5. 5	22. 5	26. 0	23. 4
313606	5. 1	32. 1	26. 6	24. 0
313606	5. 3	31. 0	27. 0	33. 9
313606	5. 5	34. 0	28. 2	25. 5
313606	5. 3	33. 2	28. 9	25. 3
313606	5. 3	32. 7	26. 2	23. 1
313606	5. 5	34. 8	27. 8	25. 1
313606	5. 4	33. 3	28. 4	25. 2
313606	5. 2	31. 3	25. 9	22. 9
313606	5. 4	34. 0	28. 0	24. 7
313606	5. 5	33. 5	28. 0	24. 9
313606	5. 4	34. 1	29. 1	25. 9
313606	5. 3	34. 8	27. 3	24. 9
313606	5. 4	32. 4	26. 0	23. 5
313606	5. 3	32. 7	27. 4	24. 4
313606	5. 1	30. 0	26. 8	23. 6
313606	5. 2	35. 0	30. 2	26. 3
313606	5. 0	30. 1	27. 0	23. 8
313606	5. 2	29. 5	26. 9	23. 1
313606	5. 0	27. 2	24. 3	21. 4
309369	5. 0	33. 3	26. 3	23. 7
309369	5. 5	33. 0	27. 3	24. 2
130842	5. 2	32. 1	27. 5	23. 8
130842	5. 0	29. 8	25. 8	22. 2
195437	5. 5	35. 4	25. 7	23. 9
Average	5. 28	32. 4	27. 1	24. 36
Greatest	5. 8	38. 2	30. 2	26. 3
Least	4. 9	26. 6	24. 0	21. 4

I am here again quite puzzled. The Worcester and Bourns journals pertaining to the Menage Expedition appear to have been lost, and while we know that they collected on the slopes of Mount Halcon and about Calapan and Naujan, we do not have definite localities applying to the numbers on the specimens. For example, their *Cochlostyla* (*Cochlodryas*) *florida* bears the number 45. The specimen I have bears the number 282. This may indicate a different zoogeographic region, and I think it does, and it is for that reason that I believe we are dealing with a distinct subspecies. Furthermore, I have no absolute intergrades between this and *C.* (*C.*) *florida florida.* I have therefore treated it as a distinct subspecies coming from somewhere in northeastern Mindoro.

COCHLOSTYLA (COCHLODRYAS) FLORIDA (?)

A series of specimens (U.S.N.M. no. 255778) collected on the east shore of Mansalay Bay show that the race occupying this region has a thick brownish periostracum and is banded like the typical race, but all our specimens are badly worn; I therefore refrain from defining and naming it here. When more material comes to hand, this race will undoubtedly have to be recognized. It is larger and heavier than and in every way different from the one that I have described from the hills on the western shore of Mansalay Bay.

COCHLOSTYLA (COCHLODRYAS) ORBITULA (Sowerby)

Plate 99, Figure 6

1841. *Helix* (*Cochlostyla*) *orbitulus* Sowerby, Proc. Zool. Soc. London, 1840, p. 103.
1842. *Helix orbitula* Pfeiffer, Symbolae, vol. 2, p. 35.
1848. *Helix orbitula* Pfeiffer, Monographia heliceorum viventium, vol. 1, p. 224.
1850. *Helix orbitula* Pfeiffer, Martini-Chemnitz Conchylien Cabinet, ed. 2, vol. 1, Abt. 12, Theil 1, pp. 296–297 (in part), pl. 50, figs. 7, 8.
1850. *Helicostyla orbitula* Albers, Die Heliceen, ed. 1, p. 104.
1851. *Helix orbitula* Reeve, Conchologia iconica, pl. 10, figs. 60a, 60b.
1851. *Helix orbitula* Deshayes, Férussac's Histoire naturelle . . . mollusques . . ., vol. 1, pp. 311–312, pl. 108A, figs. 7, 8.
1853. *Helix orbitula* Pfeiffer, Monographia heliceorum viventium, vol. 3, p. 298.
1855. *Helicostyla orbitula* H. and A. Adams, The genera of recent Mollusca, vol. 2, p. 192.
1856. *Bulimus orbitula* Pfeiffer, Malakozool. Blätter, vol. 2, p. 146.
1859. *Bulimus orbitula* Pfeiffer, Monographia heliceorum viventium, vol. 4, p. 359.
1860. *Helicostyla orbitulus* Martens, Albers, Die Heliceen, ed. 2, p. 175.
1868. *Bulimus orbitula* Pfeiffer, Monographia heliceorum viventium, vol. 5, p. 7.
1876. *Bulimus orbitula* Pfeiffer, Monographia heliceorum viventium, vol. 8, p. 7.
1877. *Cochlostyla orbitula* Semper, Reisen im Archipel der Philippinen, pt. 2, vol. 3, p. 199.
1887. *Cochlostyla orbitula* Hidalgo, Journ. Conchyl., vol. 35, p. 152.
1890. *Cochlostyla orbitula* Pilsbry, Man. Conch., ser. 2, vol. 6, p. 179, pl. 58, figs. 98, 99.

1895. *Helicostyla orbitula* Pilsbry, Man. Conch., ser. 2, vol. 9, p. 225.
1896. *Cochlostyla orbitula* Elera, Catalogo sistematico de toda la fauna de Filipinas, vol. 3, p. 585.
1897. *Cochlostyla orbitula* Hidalgo, Journ. Conchyl., vol. 44, pp. 260, 331, 335, 341, 351.
1898. *Cochlostyla orbitula* Möllendorff, Abh. Naturf. Ges. Görlitz, vol. 22, p. 131.
1901. *Cochlostyla orbitulus* Hidalgo, Obras malacologicas, p. 459, pl. 38, figs. 6, 7; pl. 95, fig. 2.
1910. *Cochlostyla orbitula* Möllendorff, Kobelt, and Winter, Semper's Reisen im Archipel der Philippinen, vol. 10, pp. 149–150, pl. 51, figs. 5, 5a.
1932. *Cochlostyla* (*Chochlodryas*) *orbitula* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 337.

Shell subglobular, covered with a thin periostracum that seems to partake of the general color scheme characterizing the particular part of the shell covered. The coloration of the nuclear whorls consists of a white area covering the posterior half of the turns and a pale chestnut-brown area covering the rest of the exposed portion. Beginning with the postnuclear whorl, there is a rather broad, conspicuous, chestnut-brown band, which rapidly increases in intensity of coloration to chocolate-brown. This band occupies the middle of the exposed portion of all the turns. On the succeeding turns a pale green band appears halfway between the brown band and the summit. This band gradually widens until it extends to the median band of brown, leaving a big broad zone of white at the summit. A second green band appears immediately above the summit of the succeeding turn, and this also gradually widens posteriorly until it reaches the median brown band. Both the posterior and the anterior green bands become diluted as they approach the median band, the deepest shade of green being at the posterior extremity of the green band in the posterior zone and the peripheral extremity in the anterior band. The base is of an orange-brown color, paler within the aperture. There is a broad brown band a little wider and of a little darker shade than the median one of the spire, and this band is separated from the green zone at the periphery by a narrow zone of the ground color of the base. The columellar area is surrounded by a chocolate-brown band. The interior of the aperture, the outer lip, and the columella are white, the dark bands showing within the aperture. Nuclear whorls almost 2, well rounded, marked by incremental lines and on the last portion of the last turn by fine spiral striations. The postnuclear whorls are appressed at the summit, strongly rounded and marked by retractively slanting lines of growth and microscopic spiral striations on both spire and base. The periphery, although well rounded, gives one the impression of being obsoletely angulated, probably because of the color pattern. The base is short, inflated, and well rounded. The aperture is broadly oval and oblique, the outer lip being decidedly expanded and reflected. The columella is slightly excavated.

The specimen described and figured (U.S.N.M. no. 313624) has 5 whorls and measures: Length, 25.6 mm; greater diameter, 25.5 mm; lesser diameter, 22.3 mm. This and a large series of specimens were collected by Worcester and Bourns on the Menage Expedition somewhere in northeastern Mindoro. A hundred of them yield the following additional measurements:

U.S.N.M. no.	Number of whorls	Length	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
313624	4. 9	26. 5	26. 6	23. 1
313624	4. 9	26. 5	26. 0	23. 1
313624	4. 8	25. 9	26. 1	22. 9
313624	5. 1	25. 0	23. 7	20. 8
313624	4. 9	24. 6	25. 8	22. 2
313624	5. 1	28. 3	27. 7	24. 7
313624	5. 0	25. 7	25. 8	22. 9
313624	5. 1	23. 9	24. 0	21. 6
313624	5. 0	23. 5	22. 0	20. 1
313624	4. 9	24. 5	24. 2	21. 9
313624	5. 0	26. 6	25. 4	22. 2
313624	5. 1	26. 6	25. 7	22. 6
313624	5. 1	26. 9	24. 5	22. 3
313624	4. 5	23. 8	26. 9	22. 9
313624	4. 8	25. 0	25. 8	22. 6
313624	4. 9	26. 8	26. 1	23. 1
313624	5. 1	27. 2	26. 6	23. 3
313624	5. 2	28. 0	25. 5	22. 9
313624	5. 2	29. 7	25. 0	23. 5
313624	5. 2	26. 3	24. 7	22. 5
313624	4. 9	26. 2	26. 0	23. 0
313624	4. 8	22. 3	23. 9	20. 8
313624	4. 8	23. 7	24. 2	21. 3
313624	5. 0	25. 3	24. 4	22. 2
313624	5. 0	26. 5	25. 0	22. 0
313624	4. 9	24. 6	24. 8	21. 3
313624	5. 1	28. 7	26. 2	23. 4
313624	5. 1	25. 2	25. 5	22. 3
313624	5. 1	28. 2	26. 1	23. 0
313624	5. 1	25. 9	25. 9	22. 1
313624	4. 9	25. 7	25. 2	22. 9
313624	5. 1	26. 7	25. 8	22. 3
313624	5. 0	26. 4	24. 2	21. 9
313624	5. 2	27. 2	25. 3	22. 3
313624	5. 1	26. 0	27. 3	24. 0
313624	4. 7	25. 0	23. 8	21. 2
313624	4. 9	25. 6	25. 9	22. 1
313624	5. 0	23. 9	23. 9	21. 0
313624	4. 9	24. 8	26. 1	22. 6
313624	4. 9	25. 5	27. 1	22. 9
313624	5. 1	27. 1	25. 2	22. 8
313624	5. 1	25. 6	26. 2	23. 6
313624	4. 6	23. 6	25. 3	22. 4
313624	4. 9	26. 7	27. 3	24. 1
313624	4. 8	23. 8	24. 3	21. 5
313624	4. 9	25. 3	24. 8	22. 0
313624	5. 0	26. 7	26. 1	23. 4
313624	4. 6	22. 9	24. 2	22. 1
313624	5. 0	26. 9	25. 9	22. 7
313624	4. 7	26. 3	26. 9	23. 8
313624	5. 1	25. 3	22. 9	29. 9

U.S.N.M. no.	Number of whorls	Length	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
313624	4.8	22.3	24.2	22.2
313624	5.1	26.6	25.0	22.7
313624	4.7	24.4	25.3	22.3
313624	5.0	25.3	27.0	24.2
313624	5.0	21.0	22.1	20.5
313624	5.0	26.9	25.5	22.7
313624	5.0	24.6	23.5	20.6
313624	4.7	24.3	24.2	21.0
313624	4.9	24.8	23.4	21.3
313624	4.3	22.5	23.3	20.9
313624	4.5	22.9	24.8	21.8
313624	5.0	24.4	23.9	21.5
313624	4.9	24.9	25.3	22.1
313624	4.8	25.5	24.9	22.1
313624	4.7	25.1	25.4	23.1
313624	4.9	26.2	25.6	22.7
313624	5.0	26.8	26.5	23.3
313624	4.9	25.6	26.7	23.4
313624	4.5	22.7	24.6	21.4
313624	4.9	25.9	26.0	23.2
313624	4.9	23.7	24.6	22.0
313624	4.8	23.8	25.5	22.4
313624	4.7	21.2	22.2	19.5
313624	4.7	24.6	24.0	21.0
313624	4.7	24.0	23.4	21.6
313624	4.8	24.8	26.8	23.2
313624	5.1	27.2	26.0	22.7
313624	5.0	24.8	25.1	22.4
313624	5.0	24.9	24.8	22.3
313624	5.4	25.9	26.3	23.2
313624	5.0	25.8	26.4	23.0
313624	5.0	24.5	25.3	23.3
313624	4.7	21.1	22.6	20.3
313624	5.0	26.3	25.9	22.6
313624	4.7	25.4	26.2	22.7
313624	4.9	26.0	25.8	23.5
313624	5.0	25.0	22.7	21.5
313624	5.0	23.8	23.9	21.0
313624	4.9	24.2	24.0	21.3
313624	5.0	27.3	27.5	23.7
313624	4.7	25.4	25.8	23.9
313624	5.0	23.7	23.5	20.8
313624	4.4	21.3	24.0	21.3
313624	4.6	26.0	26.8	23.4
313624	5.0	26.2	24.8	22.0
313624	5.0	28.3	25.9	23.7
22003	4.9	24.3	24.0	21.6
104371	5.1	25.4	21.5	20.4
104371	5.1	26.6	25.2	23.0
Average	4.92	25.29	25.105	22.4
Greatest	5.4	29.7	27.7	29.9
Least	4.3	21.0	21.5	19.5

In the huge series of specimens before me I find little variation. In some the zone between the periphery and the dark basal band is bridged by the anterior green band. The base also varies somewhat in intensity of coloration.

COCHLOSTYLA (COCHLODRYAS) MATEOI Bartsch

1932. *Cochlostyla* (*Cochlodryas*) *mateoi* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 337.

Shell subglobular. The nuclear whorls white or pale brown, depending upon the subspecies in question. The postnuclear whorls are marked by a broad median brown band and a broad brown band of the same shade at some little distance below the periphery. The columellar area may or may not be dark. On the last whorl there is usually a greenish band near the summit, and the base, with the exception of the brown band referred to above, is green or greenish. This green color is usually intensified at the periphery, where it assumes the strength of a terminal band. The interior of the aperture is white, showing the dark bands within. The peristome and columella are also white. Nuclear whorls about 2, flattened, well rounded, marked by retractively slanting axial riblets and the last one by fine, closely spaced, spiral striations. The postnuclear whorls are almost flattened, well rounded, appressed at the summit, and marked by retractively slanting lines of growth and microscopic spiral striations, which are closely spaced and present on both spire and base. The suture is moderately constricted; the periphery inflated and strongly rounded; base moderately long, inflated and rounded; the aperture is subcircular; the outer lip broadly expanded and reflected. The columella is moderately broad, reflected over the base as a white callus. A thin callus covers the parietal wall. This species, formerly known as *tenera*, is distributed over eastern Mindoro and is present on some of the islands lying southeast of Mindoro.

The following key will help distinguish the forms:

KEY TO THE SUBSPECIES OF COCHLOSTYLA (COCHLODRYAS) MATEOI

Green coloration intense... **mateoi**
Green coloration not intense, but pale........................ **sibolonensis**

COCHLOSTYLA (COCHLODRYAS) MATEOI MATEOI Bartsch

Plate 99, Figures 7, 8

1841. *Helix* (*Cochlogena*) *tenera* Sowerby, Proc. Zool. Soc. London, 1840, p. 102; not *Helix tenera* Gmelin, Systema naturae, ed. 13, vol. 1, pt. 6, p. 3653, 1791, nor *Helix tenera* Hartmann, Neue Alpina, p. 232, 1821.
1842. *Helix tenera* Pfeiffer, Symbolae, vol. 2, p. 40.
1848. *Helix tenera* Pfeiffer, Monographia heliceorum viventium, vol. 1, p. 228; in part.
1850. *Helix tenera* Pfeiffer, Martini-Chemnitz Conchylien Cabinet, ed. 2, vol. 1, Abt. 12, Theil 1, pp. 293–294, pl. 49, fig. 12.
1850. *Helicostyla tenera* Albers, Die Heliceen, ed. 1, p. 104.
1851. *Helix tenera* Reeve, Conchologia iconica, pl. 16, fig. 62c.
1853. *Helix tenera* Pfeiffer, Monographia heliceorum viventium, vol. 3, p. 174.
1855. *Helicostyla tenera* H. and A. Adams, The genera of recent Mollusca, vol. 2, p. 102.

1859. *Helix tenera* Pfeiffer, Monographia heliceorum viventium, vol. 4, p. 199.
1860. *Helicostyla tenera* Martens, Albers, Die Heliceen, ed. 2, p. 175.
1868. *Helix tenera* Pfeiffer, Monographia heliceorum viventium, vol. 5, p. 268.
1876. *Helix tenera* Pfeiffer, Monographia heliceorum viventium, vol. 7, p. 308.
1877. *Cochlostyla tenera* Semper, Reisen im Archipel der Philippinen, pt. 2, vol. 3, p. 195.
1887. *Cochlostyla tenera* Hidalgo, Journ, Conchyl., vol. 35, p. 143.
1892. *Cochlostyla tenera* Pilsbry, Man. Conch., ser. 2, vol. 7, pp. 179–180, pl. 36, fig. 31.
1895. *Helicostyla tenera* Pilsbry, Man. Conch., ser. 2, vol. 9, p. 225.
1897. *Cochlostyla tenera* Hidalgo, Journ. Conchyl., vol. 44, pp. 260, 320, 331, 332, 341, 351.
1901. *Cochlostyla tenera* Hidalgo, Obras malacologicas, pp. 462–463 (in part), pl. 38, fig. 4; pl. 50, figs. 1, 2; pl. 53, fig. 3.
1911. *Cochlostyla* (*Cochlodryas*) *tenera* Möllendorff, Kobelt, and Winter, Semper's Reisen im Archipel der Philippinen, vol. 10, pp. 250–251 (in part), pl. 51, figs. 6, 6a.
1932. *Cochlostyla* (*Cochlodryas*) *mateoi* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 337.

Shell subglobular. Nuclear whorls 2. The posterior half of the nuclear turns is pale brown, while the anterior half is white. On the postnuclear whorls a dark spiral band about halfway between the periphery and summit of the whorls encircles the turns. This band becomes on the early whorls bright chestnut-brown, while on the last it deepens to dark chocolate-brown. A similarly colored band of about the same width is present a little anterior to the periphery on the base. In addition to this there is a narrow pale-green zone separated from the summit by a narrow white thread, and another of equal intensity is present on the periphery. The columellar area may be brown or this element may be absent. In the specimens before me about two-thirds have the brown markings. The base is of a paler olivaceous-green. The interior of the aperture, the peristome, and the columella are white, the dark bands showing within the aperture. Nuclear whorls well rounded, smooth except for incremental lines and fine spiral striations on the last part of the last turn. The postnuclear whorls are slightly inflated, well rounded, appressed at the summit, and marked by strongly retractively slanting lines of growth and microscopic spiral striations. This sculpture also characterizes the base. Periphery well rounded. The base is short, somewhat inflated, and strongly rounded. The aperture is broadly oval; peristome expanded and reflected; the columella is slightly excavated.

The specimen described and figured (U.S.N.M. no. 313627) was collected by Worcester and Bourns on the Menage Expedition in northeastern Mindoro. It has 5 whorls and measures: Length, 27 mm; greater diameter, 25.5 mm; lesser diameter, 23.2 mm.

One hundred additional specimens (U.S.N.M. no. 313626) from the same source, taken at random, yield the following measurements:

Number of whorls	Length	Greater diameter	Lesser diameter
	Mm	*Mm*	*Mm*
4.7	22. 9	25. 0	21. 5
5.2	25. 8	23. 7	21. 0
4.9	24. 0	25. 5	21. 6
5.0	23. 4	23. 5	20. 4
5.0	23. 1	23. 3	20. 7
5.0	22. 8	24. 2	20. 7
4.9	21. 9	23. 1	20. 2
4.9	24. 3	26. 2	22. 3
4.8	22. 9	23. 3	20. 2
5.3	26. 8	24. 0	21. 8
4.5	20. 4	23. 0	20. 1
5.0	23. 9	24. 2	20. 7
5.1	24. 0	24. 4	21. 8
5.1	25. 6	25. 4	21. 6
4.8	21. 7	24. 8	21. 0
4.9	24. 0	24. 2	20. 8
5.1	23. 9	23. 5	20. 6
4.9	24. 9	25. 0	21. 2
4.6	19. 2	21. 3	19. 0
4.8	20. 3	21. 4	18. 1
5.0	25. 0	24. 8	21. 7
4.9	22. 1	23. 8	20. 4
5.1	26. 5	25. 8	23. 2
4.8	22. 4	24. 2	20. 8
5.1	26. 9	26. 4	22. 1
4.6	21. 6	24. 9	21. 2
5.1	27. 2	27. 3	23. 4
4.9	25. 0	26. 6	22. 6
4.8	24. 6	24. 0	21. 4
5.0	20. 3	22. 2	19. 2
4.5	18. 4	20. 7	18. 1
4.9	24. 8	25. 2	21. 4
5.0	22. 8	25. 3	21. 8
4.6	21. 2	23. 9	20. 9
5.0	22. 2	24. 3	20. 5
5.0	25. 3	25. 4	21. 8
4.3	18. 1	21. 0	18. 8
4.8	22. 9	23. 1	19. 9
5.0	23. 3	23. 2	20. 4
5.0	22. 8	24. 5	21. 5
5.0	23. 2	24. 9	21. 5
4.6	20. 8	23. 4	20. 2
4.5	21. 2	24. 3	21. 0
4.6	22. 2	24. 2	21. 3
5.0	23. 7	23. 9	20. 3
5.0	23. 9	24. 8	20. 9
5.1	23. 8	24. 5	21. 4
4.7	22. 3	22. 8	19. 9
5.0	22. 5	25. 5	21. 5
5.0	23. 4	24. 6	20. 8
5.0	23. 5	23. 9	21. 3
5.0	22. 4	23. 0	20. 2
5.2	21. 9	23. 8	20. 2
5.0	22. 7	23. 7	20. 7
5.0	22. 6	23. 2	20. 2
5.0	24. 0	24. 4	21. 4
5.0	21. 8	24. 5	21. 3
4.9	24. 2	24. 2	21. 2
4.7	23. 6	26. 4	22. 0
4.8	22. 3	22. 8	20. 1
5.0	23. 0	24. 6	20. 7

Number of whorls	Length	Greater diameter	Lesser diameter
	Mm	*Mm*	*Mm*
4.7	22.2	25.2	21.9
4.9	23.3	24.9	21.0
5.1	22.3	21.6	20.4
5.1	25.6	25.1	22.0
5.0	22.7	23.2	20.9
4.9	23.0	25.6	21.4
5.0	21.5	22.2	19.7
5.1	26.5	28.2	24.0
5.0	24.2	25.0	21.0
5.1	26.5	25.4	22.6
4.9	22.4	22.3	19.7
4.9	23.6	24.8	21.5
5.1	26.4	25.4	22.2
4.9	25.2	26.8	22.7
4.7	22.2	24.5	21.1
5.0	23.0	23.3	20.3
4.8	22.2	23.7	20.3
5.0	23.8	25.3	21.7
4.7	21.2	23.3	20.1
5.1	24.2	25.5	22.1
4.7	22.8	22.6	20.1
5.1	23.3	22.0	19.9
5.1	23.8	22.3	19.6
5.1	28.1	27.1	23.4
5.0	25.9	25.0	21.6
5.0	24.1	24.4	20.8
4.9	23.4	24.5	21.2
4.6	22.4	24.8	20.9
5.0	24.9	24.2	21.7
4.6	21.3	24.5	19.6
4.7	22.7	24.1	21.0
4.6	22.1	23.4	20.4
5.1	25.2	24.8	21.8
5.0	25.1	25.2	22.0
5.1	25.8	25.3	22.1
5.0	24.7	26.3	21.8
5.1	24.7	24.2	21.2
5.0	25.5	25.9	22.0
5.1	25.2	25.7	22.6
4.92 [1]	[1] 23.4	[1] 24.3	[1] 21.05
5.3 [2]	[2] 28.1	[2] 28.2	[2] 24.0
4.3 [3]	[3] 18.1	[3] 20.7	[3] 18.1

[1] Average. [2] Greatest. [3] Least.

COCHLOSTYLA (COCHLODRYAS) MATEOI SIBOLONENSIS Bartsch

PLATE 99, FIGURE 9

1932. *Cochlostyla* (*Cochlodryas*) *mateoi sibolonensis* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 337.

Shell very thin, semitranslucent. The nuclear whorls white, except the last turn, which is covered by a very pale greenish periostracum. As in the typical race, we have here two brown bands of about equal width encircling the turns. One of these is almost on the middle between the suture and summit, and the other one is about the same distance below the periphery on the base. Interior of the aperture, expanded peristome, and columella white. The band on the middle of the turns extends to the nuclear whorl, slowly fading posteriorly. Nuclear whorls 2, well rounded, marked by incremental lines and the last half of the last turn by fine spiral striations. The postnuclear turns are inflated, well rounded, appressed at the summit, and marked by retractively slanting lines of growth and numerous microscopic spiral striations, which are stronger on the first postnuclear turn than on the rest and quite feeble on the base. Aperture almost subcircular; the peristome of the outer lip expanded and reflected; columella rather slender, slightly excavated.

The type (U.S.N.M. no. 313629), collected by C. Canonizado at Sibolon Island, Mindoro, has 5.3 whorls and measures: Length, 27.2 mm; greater diameter, 26.1 mm; lesser diameter, 22.2 mm.

Three of the other five specimens (U.S.N.M. no. 313630) are adult. They have the following measurements:

Number of whorls	Length	Greater diameter	Lesser diameter
	Mm	*Mm*	*Mm*
5.0	25. 5	23. 8	21. 2
4.9	23. 5	25. 2	22. 2
4.8	20. 7	23. 5	21. 2

This race can readily be distinguished from typical *Cochlostyla* (*Cochlodryas*) *mateoi mateoi* by its very thin shell and broader form, as well as paler coloration.

COCHLOSTYLA (COCHLODRYAS) MATEOI, subspecies (?)

1851. *Helix tenera* Reeve, Conchologia iconica, pl. 16, fig. 62a.
1896. *Cochlostyla tenera* Elera, Catalogo sistematico de toda la fauna de Filipinas, vol. 3, p. 585; in part.
1901. *Cochlostyla tenera* Hidalgo, Obras malacologicas, pp. 462–463 (in part), pl. 118, fig. 4.
1911. *Cochlostyla* (*Cochlodryas*) *tenera* Möllendorff, Kobelt, and Winter, Semper's Reisen im Archipel der Philippinen, vol. 10, pp. 250–251 (in part), pl. 51, figs. 7, 7a.

Reeve and Hidalgo figured a specimen that has a bright buff peripheral band and an almost black band immediately posterior to this and anterior to it. I have not seen specimens with this coloration. It is possible that this may represent a distinct race, but I call it merely *mateoi* subspecies (?). I am copying their figures.

COCHLOSTYLA (COCHLODRYAS) FASTIDIOSA Bartsch

Plate 99, Figure 5

1840. *Helix* (*Cochlogena*) *tenera* Sowerby, Proc. Zool. Soc. London, 1840, p 102; not *Helix tenera* Gmelin, Systema naturae, ed. 13, vol. 1, pt. 6, p. 3653, 1791, nor *Helix tenera* Hartmann, Neue Alpina, p. 232, 1821.
1850. *Helix tenera* Pfeiffer, Martini-Chemnitz Conchylien Cabinet, ed. 2, vol. 1, Abt. 12, Theil 1, pp. 293–294 (in part), pl. 49, fig. 13.
1851. *Helix tenera* Reeve, Conchologia iconica, pl. 16, fig. 62b.
1892. *Cochlostyla tenera* Pilsbry, Man. Conch., ser. 2, vol. 7, pp. 179–180, pl. 36, fig. 32.
1897. *Cochlostyla tenera* Hidalgo, Journ. Conchyl., vol. 44, pp. 260, 320, 331, 332, 341, 351.
1901. *Cochlostyla tenera* Hidalgo, Obras malacologicas, pp. 462–463 (in part), pl. 38, fig. 5.
1932. *Cochlostyla* (*Cochlodryas*) *fastidiosa* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 337.

Shell varying in shape from helicoid to subglobular. Perfect specimens are covered with a thin translucent periostracum, which contributes largely to the coloration of the shell. The nucleus and the first 1½ postnuclear whorls are white; the remaining turns also have a basal white ground color, but there is a narrow band of pale grass green separated from the summit by a little narrow white thread. The base also is pale grass green, and this color terminates anteriorly in an intensification of this color in the shape of a moderately broad zone at the periphery. The aperture, peristome, and columella are white. The base too has spiral lines a little darker than the rest. Nuclear whorls 2.2, well rounded, marked by lines of growth, and the last half of the last turn bears within numerous closely spaced spiral striations. The postnuclear whorls are inflated, well rounded, appressed at the summit, and marked by retractively curved lines of growth and numerous closely spaced spiral striations both on spire and base. Periphery well rounded. The base is short, inflated, and well rounded. The aperture is broadly oval; peristome expanded and reflected. The columella is somewhat excavated. Parietal wall covered by a thin translucent callus.

The specimen described and figured (U.S.N.M. no. 313640), collected by Dean C. Worcester and Bourns on the Menage Expedition somewhere in northeastern Mindoro, has 5.1 whorls and measures: Length, 27.8 mm; greater diameter, 26.3 mm; lesser diameter, 22.7 mm.

We have a large series of specimens (U.S.N.M. no. 313641) from the same source, a hundred of which yield the following additional measurements:

Number of whorls	Length	Greater diameter	Lesser diameter
	Mm	*Mm*	*Mm*
4.6	24.0	25.1	21.8
4.7	23.2	25.4	21.7
4.8	22.2	25.1	21.7
5.1	24.5	23.3	21.0
4.6	21.4	22.6	19.8
4.7	22.2	24.3	20.3
5.0	25.4	25.9	23.0
5.1	28.0	25.1	21.9
5.1	26.5	26.8	22.5
5.0	22.6	26.6	22.0
4.8	23.9	24.5	21.3
4.7	24.0	26.5	23.0
4.7	23.5	25.7	21.7
5.0	26.3	25.6	22.9
5.0	25.8	25.8	22.6
5.0	27.2	24.1	21.8
5.1	23.9	24.6	21.3
5.0	25.1	26.9	23.3
5.2	29.5	27.8	23.9
5.3	27.0	26.6	22.7
5.2	25.2	26.0	23.0
4.8	27.4	27.1	24.4
4.9	24.0	23.4	20.3
4.9	24.2	26.8	21.8
5.4	27.2	26.6	23.0
4.9	25.3	25.4	21.4
5.1	25.3	25.0	22.3
5.2	27.8	26.4	22.4
4.6	21.6	23.3	20.3
5.0	25.1	25.3	21.9
5.1	25.4	24.5	21.2
4.8	23.7	24.8	22.1
4.6	22.0	24.5	21.4
5.1	24.5	25.2	21.3
5.1	24.9	23.1	20.6
5.0	24.8	25.9	22.4
5.0	24.8	23.3	20.1
4.9	24.9	24.8	22.1
4.8	25.4	24.8	21.8
4.9	23.8	25.2	21.5
5.2	25.2	24.3	22.1
4.6	21.4	23.0	19.7
5.0	25.2	26.3	22.5
5.1	25.5	22.4	20.2
5.0	24.4	25.2	22.3
4.7	22.8	23.6	21.7
4.8	23.3	24.1	21.6
5.1	26.1	27.8	23.8
5.0	25.9	26.1	21.9
4.9	22.4	23.8	20.3
5.4	27.8	25.0	22.1
4.6	20.7	24.3	20.8
5.0	24.2	26.5	22.7
5.3	24.2	24.8	22.1
5.0	21.1	23.2	20.0
4.9	24.8	25.4	22.0
4.8	24.8	25.2	22.0
4.8	22.1	25.2	22.5
5.0	25.6	26.9	23.4
4.9	25.5	26.3	22.8
5.0	24.0	26.0	21.7
5.4	26.9	25.3	22.4

Number of whorls	Length	Greater diameter	Lesser diameter
	Mm	*Mm*	*Mm*
4.9	24.2	28.1	23.7
4.7	23.5	24.9	21.1
4.6	23.7	23.9	20.3
4.8	22.2	23.3	20.3
5.1	24.0	23.6	20.9
5.0	25.9	25.6	21.9
5.0	26.8	26.0	23.0
5.0	26.2	28.1	23.7
5.1	27.1	26.3	23.3
4.6	21.9	23.0	20.2
5.0	25.6	22.8	20.5
5.0	26.4	24.8	22.7
5.0	24.8	26.5	22.4
4.8	26.8	25.8	23.3
4.9	24.3	26.7	22.9
5.3	23.8	24.3	21.5
4.9	25.3	25.3	22.3
4.7	24.8	26.8	23.6
5.0	22.3	24.8	21.3
4.6	23.6	25.6	22.0
4.6	21.6	23.8	20.6
5.1	23.6	23.3	20.4
4.9	23.7	23.8	20.5
4.9	24.5	25.3	22.0
5.1	26.3	26.1	22.7
5.2	28.1	23.8	21.2
4.4	21.0	24.4	20.2
5.0	24.4	24.8	21.6
5.0	25.3	26.1	21.9
4.9	24.8	26.3	22.3
5.1	25.8	26.0	23.1
5.0	23.9	25.7	21.9
4.5	22.1	26.3	21.8
4.6	23.2	24.8	21.8
4.8	21.8	24.6	21.0
5.2	26.8	25.2	22.1
4.6	23.3	23.8	20.6
4.6	21.7	24.2	20.8
4.93 [1]	[1] 24.525	[1] 25.15	[1] 21.89
5.4 [2]	[2] 29.5	[2] 28.1	[2] 24.4
4.4 [3]	[3] 20.7	[3] 22.4	[3] 19.7

[1] Average.

[2] Greatest.

[3] Least.

Some specimens seem to be almost white, but even these show an indication of a peripheral and a subsutural green band.

The name originally proposed by Sowerby is not tenable since it was twice preoccupied, as shown in my synonymy. Sowerby too, and the authors who followed him, confused two species under this name, considering them mere color forms. Hundreds of specimens before me show no intergrades of one to the other and lead me to believe that the banded form, which has been passing under the name *Cochlostyla* (*Cochlodryas*) *tenera*, merits specific separation. This is indicated the more since races of it occur on some of the off-lying islands. I have therefore named the banded shell *Cochlostyla* (*Cochlodryas*) *mateoi*, and of this I recognize a number of races.

COCHLOSTYLA (COCHLODRYAS) DECORA (Adams and Reeve)

Plate 100, Figures 4, 5

1850. *Helix decora* Adams and Reeve, The zoology of the voyage of H. M. S. *Samarang*, p. 62, pl. 16, fig. 7.
1852. *Helix decora* Reeve, Conchologia iconica, pl. 105, fig. 586.
1853. *Helix decora* Pfeiffer, Monographia heliceorum viventium, vol. 3, p. 178.
1854. *Helix decora* Pfeiffer, Martini-Chemnitz Conchylien Cabinet, ed. 2, vol. 1, Abt. 12, Theil 3, pp. 401–402, pl. 144, figs. 18, 19.
1855. *Acavus* (*Tachea*) *decorus* H. and A. Adams, The genera of recent Mollusca, vol. 2, p. 195.
1856. *Helix decora* Pfeiffer, Malakozool. Blätter, vol. 2, p. 145.
1859. *Helix decora* Pfeiffer, Monographia heliceorum viventium, vol. 4, p. 202.
1860. *Helicostyla decora* Martens, Albers, Die Heliceen, ed. 2, p. 175.
1868. *Helix decora* Pfeiffer, Monographia heliceorum viventium, vol. 5, p. 270.
1876. *Helix decora* Pfeiffer, Monographia heliceorum viventium, vol. 7, p. 578; in part.
1892. *Cochlostyla decora* Pilsbry, Man. Conch., ser. 2, vol. 7, p. 133, pl. 52, figs. 23, 24.
1895. *Helicostyla decora* Pilsbry, Man. Conch., ser. 2, vol. 9, p. 122.
1897. *Cochlostyla decora* Hidalgo, Journ. Conchyl., vol. 44, pp. 278, 331, 340, 352.
1898. *Cochlostyla decora* Möllendorff, Abh. Naturf. Ges. Görlitz, vol. 22, p. 122; in part.
1904. *Cochlostyla decora* Hidalgo, Obras malacologicas, p. 470, pl. 48, fig. 4.
1910. *Cochlostyla decora* Möllendorff, Kobelt, and Winter, Semper's Reisen im Archipel der Philippinen, vol. 10, p. 206; in part.
1932. *Cochlostyla* (*Cochlodryas*) *decora* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 337.

Shell imperforate, conoidal globose, pale straw color, covered with a fawn-colored epidermis, obliquely striated; whorls 4, rather flattened, the last faintly keeled; aperture lunar orbicular, white within, lip reflected, white, shining.

Habitat: Island of Mindoro, Philippines.

I have not seen specimens of this species. Von Möllendorff seems to think that he has recognized this species in shells from the Island of Romblon, but I am inclined to disagree with von Möllendorff. The fact that he did not rediscover it in Mindoro is not at all surprising, because little work has been done to date in the southwestern portion of Mindoro, and it is more than likely that when an ardent collector combs this part of the territory visited by the *Samarang*, the species will be rediscovered. This has been true of most of the shells that were originally stated to come from a locality or from an island, and whose names were later transferred to other races from other islands. I therefore prefer to copy Adams and Reeve's description and figure.

Subgenus STEATODRYAS Pilsbry

In this subgenus the shell is of inflated turbinate shape and rather thin. The whorls are many, inflated, strongly rounded, and closely coiled. The surface is covered by a thin hydrophanous periostracum. The aperture is narrowly lunate. The columella is spirally twisted, the edge of the twist forming a sublamellar fold.

Type: *Cochlostyla* (*Steatodryas*) *cepoides* (Lea).

COCHLOSTYLA (STEATODRYAS) CEPOIDES (Lea)

PLATE 100, FIGURES 6–8

1840. *Helix cepoides* LEA, Proc. Amer. Phil. Soc., vol. 1, p. 174.
1841. *Helix* (*Helicostyla*) *cepoides* SOWERBY, Proc. Zool. Soc. London, 1840, p. 88.
1841. *Helix cepoides* LEA, Trans. Amer. Phil. Soc., new ser., vol. 7, p. 462, pl. 12, fig. 14.
1842. *Helix cepoides* REEVE, Conchologia systematica, vol. 2, p. 70, pl. 164, fig. 14.
1842. *Helix cepoides* PFEIFFER, Symbolae, vol. 2, p. 2.
1843. *Columplica dolium* HARTMANN, Erd- und Süsswasser-Gasteropoden der Schweiz, pp. 187–188, pl. 67, figs. 1, 2.
1848. *Helix cepoides* PFEIFFER, Monographia heliceorum viventium, vol. 1, p. 302.
1849. *Helix cepoides* PFEIFFER, Martini-Chemnitz Conchylien Cabinet, ed. 2, vol. 1, Abt. 12, Theil 1, p. 268, pl. 41, figs. 3, 4.
1850. *Pachya dolium* ALBERS, Die Heliceen, ed. 1, p. 107.
1851. *Helix dolium* REEVE, Conchologia iconica, pl. 8, fig. 39.
1851. *Helix dolium* DESHAYES, Férussac's Histoire naturelle . . . mollusques . . ., vol. 1, p. 312, pl. 108B, figs. 1, 2.
1853. *Helix dolium* PFEIFFER, Monographia heliceorum viventium, vol. 3, p. 207.
1855. *Stylodonta dolium* H. and A. ADAMS, The genera of recent Mollusca, vol. 2, p. 187.
1856. *Helix dolium* PFEIFFER, Malakozool. Blätter, vol. 2, p. 139.
1859. *Helix dolium* PFEIFFER, Monographia heliceorum viventium, vol. 4, p. 241.
1860. *Stylodon dolium* MARTENS, Albers, Die Heliceen, ed. 2, p. 150
1868. *Helix dolium* PFEIFFER, Monographia heliceorum viventium, vol. 5, p. 111.
1876. *Helix dolium* PFEIFFER, Monographia heliceorum viventium, vol. 7, p. 358.
1877. *Cochlostyla dolium* SEMPER, Reisen im Archipel der Philippinen, pt. 2, vol. 3, p. 181.
1886. *Nanina dolium* TRYON, Man. Conch., vol. 2, p. 26, pl. 6, figs. 86, 87.
1887. *Helix dolium* HIDALGO, Journ. Conchyl., vol. 35, p. 106.
1888. *Cochlostyla* (*Ptychostylus*) *cepoides* MÖLLENDORFF, Nachr. deutschen malakozool. Ges., vol. 20, pp. 73, 74.
1891. *Cochlostyla cepoides* PILSBRY, Man. Conch., ser. 2, vol. 6, p. 194, pl. 48, fig. 69.
1895. *Helicostyla cepoides* PILSBRY, Man. Conch., ser. 2, vol. 9, p. 226.
1896. *Ptychostylus cepoides* ELERA, Catalogo sistematico de toda la fauna de Filipinas, vol. 3, p. 588.
1897. *Cochlostyla cepoides* HIDALGO, Journ. Conchyl., vol. 44, pp. 248, 270, 280, 331, 340, 351.
1898. *Cochlostyla cepoides* MÖLLENDORFF, Abh. Naturf. Ges. Görlitz, vol. 22, p. 134.
1901. *Cochlostyla cepoides* HIDALGO, Obras malacologicas, pp. 352–353, pl. 44, figs. 3–5.
1912. *Cochlostyla* (*Columplica*) *cepoides* MÖLLENDORFF, KOBELT, and WINTER, Semper's Reisen im Archipel der Philippinen, vol. 10, pp. 266–267, pl. 54, fig. 8.

1932. *Cochlostyla (Columplica) cepoides* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 337.

1932. *Steatodryas cepoides* Pilsbry, Nautilus, vol. 46, p. 72.

Shell semiglobose, turbinate, covered with a thin reddish-brown periostracum, which forms a subsutural band at the summit, in which whitish and darkish spots alternate, the lighter spots being occasioned by the periostracum. There is also a subperipheral hydrophanous spiral band present. The rest of the shell is reddish brown on the spire, tending toward olivaceous-yellow on the base. The interior

U.S.N.M. no.	Number of whorls	Length	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
254554	6.3	36.7	46.6	39.7
254554	6.4	36.1	42.7	37.5
7596	7.4	50.9	51.4	46.0
7596	6.7	44.6	45.0	42.3
7596	7.2	40.0	46.5	42.4
313636	7.0	39.5	47.3	42.4
313636	7.1	41.0	46.3	42.5
313636	7.1	41.4	44.7	41.9
313636	7.0	48.9	43.0	38.1
195396	6.7	34.0	43.5	39.6
195396	7.0	40.0	44.8	41.3
195396	7.1	38.5	46.0	41.2
195396	7.3	41.7	46.0	40.9
208220	7.3	46.5	50.6	45.6
208220	7.0	41.2	52.7	45.9
103944	7.3	44.6	46.8	43.2
255946	7.2	48.3	48.7	44.5
255946	7.3	45.5	51.0	45.4
255946	6.3	37.3	42.6	38.0
255946	7.0	38.4	43.9	39.2
255946	6.6	38.8	45.0	39.8
255946	7.1	44.4	49.1	44.1
255946	6.8	40.7	46.0	40.7
255946	7.0	43.7	38.0	43.3
255946	7.0	43.1	47.1	43.3
255946	7.1	46.3	47.8	42.4
255946	7.0	40.3	44.4	41.0
255946	7.2	45.0	49.0	44.0
255946	6.9	44.2	46.0	41.4
255946	6.5	39.1	43.2	38.5
255496	7.4	48.4	48.6	43.7
255496	7.3	41.9	45.9	41.0
255496	7.0	41.9	48.4	43.7
255496	7.2	44.7	47.6	42.4
255496	6.9	40.7	42.0	38.5
255496	7.2	43.4	48.4	43.0
255496	6.7	40.1	43.8	39.3
254496	6.9	42.4	49.1	43.0
255496	7.2	42.8	45.9	40.8
309408	7.3	40.0	46.7	41.8
22010	7.0	43.0	47.1	42.5
309407	7.1	40.9	51.5	54.6
Average	7.0	42.16	46.44	41.93
Greatest	7.4	50.9	52.7	46.0
Least	6.3	34.0	38.0	38.0

of the aperture and columella are bluish white, while the outer lip is edged with pale brown. Nuclear whorls 1.6, well rounded, marked by lines of growth only. The postnuclear whorls are inflated, strongly rounded, and marked by retractively slanting lines of growth and microscopic spiral striations, which are present on both spire and base. As the suture is strongly constricted, the shell has a turbinate appearance. Periphery well rounded. Base short, inflated, well rounded, narrowly perforated; aperture lunate, narrow; outer lip expanded and reflected; the columella with a strong twist, which gives it a toothlike appearance.

Lea's type was collected by Lt. W. W. Wood, and while the locality is given as Philippine Islands, we now know that the species is restricted to the Island of Lubang.

The type (U.S.N.M. no. 116392) has 7 whorls and measures: Length, 40.1 mm; greater diameter, 52 mm; lesser diameter 45.8 mm.

Additional specimens yield the measurements given in the foregoing table.

Subgenus HELICOBULINUS Broderip

In this subgenus the shell is large, globose-turbinate, and covered with a hydrophanous periostracum of widely varied color. The columella is more or less folded.

Type: *Cochlostyla* (*Helicobulinus*) *sarcinosa* (Férussac).

COCHLOSTYLA (HELICOBULINUS) TURBO (Pfeiffer)

PLATE 100, FIGURES 1, 2

1845. *Helix turbo* PFEIFFER, Proc. Zool. Soc. London, 1845, p. 64.
1848. *Helix turbo* PFEIFFER, Monographia heliceorum viventium, vol. 1, p. 220.
1849. *Helix turbo* PFEIFFER, Martini-Chemnitz Conchylien Cabinet, ed. 2, vol. 1, Abt. 12, Theil 1, p. 286, pl. 48, figs. 1, 2.
1850. *Bulimus* (*Orthostylus*) *turbo* ALBERS, Die Heliceen, ed. 1, p. 136.
1851. *Helix turbo* REEVE, Conchologia iconica, pl. 19, fig. 81.
1851. *Helix turbo* DESHAYES, Férussac's Histoire naturelle . . . mollusques . . . , vol. 1, p. 318, pl. 110B, fig. 1.
1853. *Helix turbo* PFEIFFER, Monographia heliceorum viventium, vol. 3, p. 171; in part.
1855. *Cochlostyla turbo* H. and A. ADAMS, The genera of recent Mollusca, vol. 2, p. 142.
1856. *Helicobulinus turbo* PFEIFFER, Malakozool. Blätter, vol. 2, p. 145.
1859. *Helix turbo* PFEIFFER, Monographia heliceorum viventium, vol. 5, p. 205.
1860. *Cochlodryas turbo* MARTENS, Albers, Die Heliceen, ed. 2, p. 176.
1868. *Helix turbo* PFEIFFER, Monographia heliceorum viventium, vol. 5, p. 274.
1876. *Helix turbo* PFEIFFER, Monographia heliceorum viventium, vol. 7, p. 318.
1877. *Cochlostyla turbo* SEMPER, Reisen im Archipel der Philippinen, pt. 2, vol. 3, p. 195.
1887. *Cochlostyla turbo* HIDALGO, Journ. Conchyl., vol. 35, p. 139; in part.
1892. *Cochlostyla cinerascens turbo* PILSBRY, Man. Conch., ser. 2, vol. 7, pp. 197–198, pl. 47, fig. 9.

1895. *Helicostyla turbo* Pilsbry, Man. Conch., ser. 2, vol. 9, p. 227.
1896. *Cochlostyla turbo* Elera, Catalogo sistematico de toda la fauna de Filipinas, vol. 3, p. 590; in part.
1897. *Cochlostyla turbo* Hidalgo, Journ. Conchyl., vol. 44, pp. 253, 254, 272, 321, 330, 331, 332, 333, 341, 347, 351.
1898. *Cochlostyla turbo* Möllendorff, Abh. Naturf. Ges. Görlitz, vol. 22, p. 135; in part.
1901. *Cochlostyla turbo* Hidalgo, Obras malacologicas, pp. 355–356; in part.
1912. *Cochlostyla* (*Rhymbocochlias*) *turbo* Möllendorff, Kobelt, and Winter, Semper's Reisen im Archipel der Philippinen, vol. 10, p. 268; in part.
1932. *Cochlostyla* (*Helicobulinus*) *turbo* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 337.

Shell imperforate, top-shaped, rather solid, obliquely distinctly striated, pale flesh-color, covered in part with a thin evanescent yellow periostracum. Spire regularly conic, gradually tapering toward the obtuse apex. Whorls 5, flat, the last rather large, angulated at the periphery, where it is marked by a chestnut-brown band. The base slopes conspicuously from the periphery, which is only slightly arched. The columella is almost vertical, straight, broad, flat, and white. The aperture is almost diagonal to the axis of the shell and is of irregular lunate form, pearly white within. The peristome is somewhat expanded and reflected backward at its junction with the columella, forming there a small rimation.

Length, 35 mm; greater diameter, 43 mm.

Habitat: Island of Mindoro.

Of the figure that Pfeiffer published in Martini-Chemnitz Conchylien Cabinet, p. 287, pl. 48, figures 1 and 2, which we here reproduce, he says: "The notch which the artist who drew the figure reproduced all too accurately in his drawings is merely an accidental monstrosity."

I have not seen this species.

Subgenus ORTHOSTYLUS Beck

In this subgenus the shell is large, solid, and ovate-conic. It is covered with a hydrophanous periostracum that presents much variation in thickness and color in the different species of the group. The aperture is ovate and oblique and the peristome moderately expanded and reflected. The columella is almost vertical and more or less folded.

Type: *Cochlostyla* (*Orthostylus*) *pithogaster* (Férussac).

COCHLOSTYLA (ORTHOSTYLUS) EUCONICA Bartsch

Plate 100, Figure 3

1932. *Cochlostyla* (*Orthostylus*) *euconica* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 337.
1933. *Helicostyla* (*Orthostylus*) *pithogaster* Clench and Archer, Papers Michigan Acad. Sci., Arts, Letters, vol. 17, p. 543.

Shell broadly conic, covered by a thin periostracum, which varies from grayish brown to wood brown. When the periostracum is removed from the earlier turns, they are shown to be flesh color or flesh color with a pinkish brown tint, the succeeding turns becoming gradually darker until the last one is bright chestnut-brown between the periphery and summit and bright dark chestnut-brown on the base. The interior of the aperture is bluish white, and the peristome is edged with brown; the columella has a pinkish cast. Nuclear whorls 1.5, well rounded, marked only by lines of growth. The postnuclear turns are moderately rounded, appressed at the summit, and marked by retractively slanting lines of growth, which are a little stronger on the last turn than on the early whorls, and also by microscopic closely crowded spiral striations, which are present on both spire and base. Suture moderately constricted; periphery of the last whorl obsoletely angulated. The base is short, somewhat inflated, and strongly rounded. The aperture is almost circular, oblique; outer lip slightly expanded and reflected. The columella is moderately broad, slightly excavated, and reflected at its insertion over the base, and the parietal wall has a moderately thick callus.

The type (U.S.N.M. no. 313637) was collected by Pedro de Mesa on Mount Sapol, Calapan, Mindoro. It has 5.7 whorls and measures: Length, 50.3 mm; greater diameter, 39.2 mm; lesser diameter, 34 mm.

Two topotypes (U.S.N.M. no. 313638), from the same source, yield, respectively, the following measurements: 5.7 whorls each; length, 52.3 and 51.8 mm; greater diameter, 39.5 and 40 mm; lesser diameter, 34.7 mm each.

This species belongs to the group of *Cochlostyla* (*Orthostylus*) *pithogaster*, not treated in this paper. It is a group much in need of revision, for the name *Cochlostyla pithogaster* has been used as a catch-all. In order thoroughly to understand its relationship to the other members of the group, it would be necessary to revise the group, which is not within the province of the present paper.

Subgenus HYPSELOSTYLA Martens

In this subgenus the shell is elongate-ovate to conic, imperforate, with more or less keeled periphery, and covered with a thin hydrophanous periostracum. The aperture is oval to subquadrate, and the peristome is but slightly expanded and reflected.

Since no type appears to have been definitely designated for the group, I now select *Cochlostyla* (*Hypselostyla*) *nympha* (Pfeiffer), one of the two species mentioned by von Martens.

COCHLOSTYLA (HYPSELOSTYLA) CINCINNIFORMIS (Sowerby)

Shell ovate-conic, usually rather thin, never ponderous, covered with a thin periostracum, which in the various races varies from pale straw color through yellow and pale orange-brown to grayish brown. The color of the shell from which the periostracum has been removed may be completely white. In all the specimens before me, regardless of the race involved, except *Cochlostyla* (*Hypselostyla*) *cincinniformis lubanensis*, there is an indication of a dark columellar area on the base. The intensity of this coloration varies from pale brown to almost black. A peripheral dark zone is also present and is even indicated weakly in *lubanensis*. The extent of this peripheral zone varies in the different races; sometimes it constitutes a narrow line, while in other races it forms a broad band, and the intensity of coloration is also variable. In some of the races it is very pale brown, while in others it is almost black. What I have said of the peripheral band applies also to the dark band at the summit, which is present in all the races and almost obsolete in *lubanensis*. As a rule the intensity of coloration expressed, whether pale or dark, holds good for all the dark zones, whether circumbilical, peripheral, or the band at the summit. The light zones between the dark bands vary in intensity from white to flesh color to pale straw color to pale orange-brown. The nuclear whorls in most of the races are white; in some, however, they are dark, and it will be interesting to see whether the dark-tipped and light-tipped forms represent elements taken from the same colony (that is, stock) or distinct colonies.

The distribution of the species extends from Cabra Island on the north through Lubang, Golo Island, to northern Mindoro, breaking up into local races, several of which are present on Lubang.

KEY TO THE SUBSPECIES OF COCHLOSTYLA (HYPSELOSTYLA) CINCINNIFORMIS

Columellar area of base with brown patch.
  Light area of base cinnamon-rufous.
    Dark bands of base and spire cinnamon-rufous................**ultima**
    Dark bands of base and spire not cinnamon-rufous.
      Dark bands of base and spire brownish black..........**demesana**
  Light area of base not cinnamon-rufous.
    Light area of base flesh-color................................**menagei**
    Light area of base not flesh-color.
      Light area of base straw-color or yellowish orange.
        Shell rather slender........................**cincinniformis**
        Shell rather stout.
          Whorls well rounded......................**guntingana**
          Whorls flattened..........................**cabrasensis**
Columellar area of base without brown patch......................**lubanensis**

COCHLOSTYLA (HYPSELOSTYLA) CINCINNIFORMIS ULTIMA (Clench and Archer)

Plate 101, Figure 2

1931. *Helicostyla cincinniformis ultima* Clench and Archer, Occ. Papers Boston Soc. Nat. Hist., vol. 5, pp. 335–336, pl. 17, fig. 4.

1932. *Cochlostyla* (*Hypselostylus*) *cincinniformis ultima* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 337.

Shell broadly ovate-conic. Early whorls white. The early postnuclear whorls show a reddish-brown band at the summit that increases in intensity as the shell progresses in size, but even on the last turn it is but pale brown. There is also a fairly broad peripheral zone of brown, which shows in the suture on the last two whorls. This band is flanked posteriorly and anteriorly by a reddish-brown suffusion, which on the base sometimes extends almost entirely over it. The umbilical area is likewise marked with a zone of reddish brown corresponding in intensity with the peripheral band. The band at the summit and at the periphery and on the base of the last turn shows axial hydrophanous lines, which give a somewhat vertebrated appearance to the band at the summit and the periphery. The interior of the aperture and columella is bluish white, while the outer lip is edged with brown. Nuclear whorls about 2, well rounded, marked by lines of growth only. The postnuclear whorls are slightly rounded and marked by rather strong retractively curved lines of growth, which assume almost a threadlike appearance. They become somewhat enfeebled on the base. In addition to this the entire surface of the shell is marked by fine, closely spaced, spiral striations.

U.S.N.M. no.	Number of whorls	Length	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
313584	6.0	37.4	27.4	24.4
313584	5.8	37.0	27.0	24.2
313584	5.3	34.9	26.2	23.4
313584	5.4	34.0	25.6	22.6
313584	5.6	37.4	27.3	23.9
313584	5.5	31.7	23.3	21.3
313584	5.9	37.4	26.7	23.4
313584	5.5	30.9	26.0	22.4
313584	5.5	35.3	26.4	24.8
313584	5.5	35.4	25.7	23.2
313584	5.6	34.8	23.8	22.2
313584	5.5	35.4	26.7	23.6
313584	5.1	31.3	25.4	22.1
313584	5.4	36.0	27.0	24.1
313583	5.1	34.2	25.6	23.7
313583	5.8	36.0	26.5	23.1
313583	5.2	33.8	24.8	22.7
313583	5.5	36.9	26.0	23.0
313583	5.6	40.2	27.4	24.8
313583	5.1	31.4	24.2	22.0
313583	5.2	34.3	26.3	23.5
313583	5.6	35.2	25.8	22.4
313583	5.4	33.4	24.7	22.7
313583	5.6	36.0	26.4	24.1
313583	5.5	36.6	25.8	22.9
313583	5.6	38.2	27.3	23.9
313583	5.9	37.4	26.6	24.3
Average	5.5	35.28	26.0	23.3
Greatest	6.0	40.2	27.4	24.8
Least	5.1	30.9	23.3	21.3

Suture moderately constricted. Periphery of the last whorl obsoletely angulated. Base moderately long, inflated, well rounded. Aperture almost subquadrate, slightly oblique. Outer lip narrowly expanded and reflected. Columella only moderately broad with a twist on its anterior third.

The specimen described and figured (U.S.N.M. no. 104378) is one of a series of specimens presented to the United States National Museum by Pedro de Mesa, who collected them on Golo Island. It has 5.5 whorls and measures: Length, 37.9 mm; greater diameter, 27.2 mm; lesser diameter, 24.4 mm.

The rest of the collection furnishes the data given in the foregoing table.

This race is easily distinguished from the other members by its peculiar reddish-brown banding.

COCHLOSTYLA (HYPSELOSTYLA) CINCINNIFORMIS DEMESANA (Clench and Archer)

Plate 101, Figure 11

1931. *Helicostyla cincinniformis demesana* Clench and Archer, Occ. Papers Boston Soc. Nat. Hist., vol. 5, p. 336, pl. 17, fig. 5.

1932. *Cochlostyla* (*Hypselostylus*) *cincinniformis demesana* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 337.

Shell elongate-ovate. Nuclear whorls dark; the postnuclear turns are marked by a broad band of brown at the summit and another at the periphery, and a dark area about the umbilical region. These bands are beautifully marked by axial hydrophanous lines of a pale buff color, which give to the sutures a distinctly vertebrated aspect. On the last whorl an orange-brown suffusion extends posteriorly from the peripheral blackish-brown band and also anteriorly, almost covering, in fact completely so at the lip, the light zone between the dark umbilical area and the peripheral band where the periostracum is present; this also seems to be tinged with the basal color although it likewise has a golden-buff sheen. The interior of the aperture is pearly gray, and the outer lip and the base of the columella are pale brown. The spiral dark bands show inconspicuously within the aperture, though they are readily perceived. Nuclear whorls almost 2, well rounded, marked only by lines of growth. The postnuclear whorls are well rounded, appressed at the summit, and marked by retractively slanting lines of growth, which are crossed by numerous, closely spaced, microscopic spiral striations on both spire and base. The suture is moderately constricted and the periphery obsoletely angulated. The aperture is subquadrate; outer lip slightly expanded and reflected.

The specimen described and figured (U.S.N.M. no. 313582) is one of a series collected by Pedro de Mesa at Aparico, Golo Island. It has

5.8 whorls and measures: Length, 37.5 mm; greater diameter, 25 mm; lesser diameter, 22.8 mm.

The rest of the specimens (U.S.N.M. no. 313582) furnish the following data:

Number of whorls	Length	Greater diameter	Lesser diameter
	Mm	*Mm*	*Mm*
5.5	35.0	26.0	23.0
5.3	36.6	26.0	23.1
5.5	30.5	24.1	21.2
5.8	33.2	25.0	21.5
5.6	36.5	27.3	23.2
5.5	40.0	24.1	21.7
5.5	34.2	24.5	22.2
5.4	37.1	26.9	24.1
5.3	34.5	26.6	23.0
5.0	30.2	24.8	21.6
5.1	31.8	24.5	21.7
5.4	33.0	24.5	22.0
5.4	33.6	24.6	22.6
5.1	30.9	23.9	21.7
5.4 [1]	[1] 34.08	[1] 25.2	[1] 22.33
5.8 [2]	[2] 40.0	[2] 27.3	[2] 24.1
5.0 [3]	[3] 30.2	[3] 23.9	[3] 21.2

[1] Average. [2] Greatest. [3] Least.

This subspecies is easily distinguished from the others by its brown suffusion on the last turn, in which respect it recalls *Cochlostyla* (*Hypselostyla*) *cincinniformis ultima*, which also comes from Golo Island but probably from another locality. The dark-brown bands in this race will easily distinguish it from the bright reddish-brown band of *C.* (*H.*) *cincinniformis ultima.*

COCHLOSTYLA (HYPSELOSTYLA) CINCINNIFORMIS MENAGEI Bartsch

Plate 101, Figure 1

1932. *Cochlostyla* (*Hypselostylus*) *cincinniformis menagei* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 338.

Shell broadly ovate. Nucleus and the early postnuclear whorls milky white. Beginning with the second postnuclear whorl, the brown band at the summit makes its appearance, first as a light faint brown line gradually increasing in width and intensity. What is said of the line at the summit also holds good at the peripheral zone, which shows partly above the suture. There is a broad dark umbilical area corresponding in intensity of coloration with the peripheral band and the band at the summit on the last turn. The spaces between these zones are milk-white, and so is the inside of the aperture and the outer lip and the columella except where the dark bands show through. The periostracum where present is pale straw color, and in the case of the dark zones the periostracum extends across the dark zones in perfect specimens as slender light threads. Nuclear whorls almost 2, well rounded, marked only by lines of growth. The postnuclear whorls are moderately well rounded, appressed at the summit, and marked by decidedly retractively slanting growth lines and closely spaced microscopic spiral striations, which are present on both spire and base. The periphery is almost rounded, the obsolete angle being scarcely perceptible. Base moderately long, somewhat inflated and strongly rounded. The aperture is subquadrate, oblique, and the outer lip slightly expanded and reflected. The columella is very narrow and bears a slight fold near its anterior limit.

The type (U.S.N.M. no. 313578) was collected on the Menage Expedition to Mindoro, and since this expedition worked only in northeastern Mindoro and on the slopes of Mount Halcon, it is presumed that the specimens were obtained somewhere in that region. The type has 5.5 whorls and measures: Length, 36.8 mm; greater diameter, 26.3 mm; lesser diameter, 23 mm.

A large series of additional specimens from the same source, most of which unfortunately are young, are before me. The adult shells yield the following data:

U.S.N.M. no.	Number of whorls	Length	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
313578	5. 2	35. 8	26. 5	23. 3
313580	5. 5	34. 1	25. 0	22. 3
313580	5. 5	34. 3	24. 8	22. 5
313581	5. 2	36. 2	26. 7	24. 1
105259	5. 6	39. 9	26. 8	23. 7
Average	5. 4	36. 06	25. 96	23. 18
Greatest	5. 6	39. 9	26. 8	24. 1
Least	5. 2	34. 1	24. 8	22. 3

This subspecies is easily distinguished from the others by its much more vivid coloration, the light areas being much more intensely white and the dark areas equally intensely dark, but the dark areas are not so broad as in typical *Cochlostyla* (*Hypselostyla*) *cincinniformis cincinniformis*, and consequently the shell as a whole appears paler than in the typical race.

COCHLOSTYLA (HYPSELOSTYLA) CINCINNIFORMIS CINCINNIFORMIS (Sowerby)

Plate 101, Figure 12

1841. *Helix cincinniformis* Sowerby, Proc. Zool. Soc. London, 1841, pp. 17–18.
1842. *Achatina cincinniformis* Pfeiffer, Symbolae, vol. 2, p. 57.
1848. *Bulimus cincinniformis* Pfeiffer, Monographia heliceorum viventium, vol. 2, p. 9.
1850. *Amphidromus cincinniformis* Albers, Die Heliceen, ed. 1, p. 139.

1851. *Bulimus cincinniformis* REEVE, Conchologia iconica, pl. 6, fig. 28.
1851. *Bulimus cincinniformis* DESHAYES, Férussac's Histoire naturelle . . . mollusques . . ., vol. 1, pp. 45–46 (in part), pl. 157, figs. 3, 4.
1853. *Bulimus cincinniformis* PFEIFFER, Monographia heliceorum viventium, vol. 3, p. 300; in part.
1855. *Bulimus cincinniformis* PFEIFFER, Martini-Chemnitz Conchylien Cabinet, ed. 2, vol. 1, Abt. 13, Theil 1, p. 181, pl. 53, figs. 6, 7.
1855. *Cochlostyla* (*Eudoxus*) *cincinniformis* H. and A. ADAMS, The genera of recent Mollusca, vol. 2, p. 144.
1856. *Amphidromus cincinniformis* PFEIFFER, Malakozool. Blätter, vol. 2, p. 146.
1859. *Bulimus cincinniformis* PFEIFFER, Monographia heliceorum viventium, vol. 4, p. 361.
1860. *Cochlodryas cincinniformis* MARTENS, Albers, Die Heliceen, ed. 2, p. 176.
1868. *Bulimus cincinniformis* PFEIFFER, Monographia heliceorum viventium, vol. 5, p. 8.
1877. *Cochlostyla cincinna* SEMPER, Reisen im Archipel der Philippinen, pt. 2, vol. 3, p. 211; in part.
1877. *Bulimus cincinniformis* PFEIFFER, Monographia heliceorum viventium, vol. 8, p. 9; in part.
1887. *Cochlostyla cincinniformis* HIDALGO, Journ. Conchyl., vol. 35, p. 175.
1890. *Cochlostyla cincinniformis* PILSBRY, Man. Conch., ser. 2, vol. 6, pp. 18, 19, pl. 6, figs. 21–24.
1895. *Helicostyla cincinniformis* PILSBRY, Man. Conch., ser. 2, vol. 9, p. 228.
1896. *Hypselostyla cincinniformis* ELERA, Catalogo sistematico de toda la fauna de Filipinas, vol. 3, p. 599; in part.
1897. *Cochlostyla cincinniformis* HIDALGO, Journ. Conchyl., vol. 44, pp. 272, 331, 340, 347, 350.
1898. *Cochlostyla cincinniformis* MÖLLENDORFF, Abh. Naturf. Ges. Görlitz, vol. 22, p. 133; in part.
1901. *Cochlostyla cincinniformis* HIDALGO, Obras malacologicas, pp. 528–530, pl. 71, figs. 4–6.
1912. *Cochlostyla cincinniformis* MÖLLENDORFF, KOBELT, and WINTER, Semper's Reisen im Archipel der Philippinen, vol. 10, pp. 262–263 (in part), pl. 53, fig. 6.
1912. *Cochlostyla cincinniformis unitaeniata* MÖLLENDORFF, KOBELT, and WINTER, *ibid.*, p. 263 (in part), pl. 53, figs. 7, 7a.
1912. *Cochlostyla cincinniformis tritaeniata* MÖLLENDROFF, KOBELT, and WINTER, *ibid.*, p. 263 (in part), pl. 53, fig. 6.
1931. *Helicostyla cincinniformis* CLENCH and ARCHER, Occ. Papers Boston Soc. Nat. Hist., vol. 5, p. 334, pl. 17, fig. 3.
1932. *Cochlostyla* (*Hypselostylus*) *cincinniformis cincinniformis* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 337.

Shell elongate-ovate. Periostracum where present pale straw-color. The nuclear whorls are dark, although the last one has the posterior half light. The postnuclear whorls are bluish white. They have a dark blackish-brown band at the summit and another at the periphery that usually shows about as far above the suture as the summit band is below it. The umbilical area also is of the same blackish-brown color. All these bands show within the aperture. The aperture, barring the brown bands, is bluish white, and so are the peristome and columella.

The specimen described and figured (U. S. N. M. no. 255790) is one of three I collected at Tilig, Lubang Island. It has 5.6 whorls and measures: Length, 42 mm; greater diameter, 26.5 mm; lesser diameter, 23.7 mm.

A series of additional specimens furnishes the following data:

U.S.N.M. no.	Number of whorls	Length	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
255790	5.9	39.3	26.4	23.7
255790	5.6	42.2	26.3	24.0
255790	5.8	40.0	26.0	23.0
255291	5.2	37.1	27.9	24.6
313576	5.1	33.2	24.4	22.2
313576	5.9	41.0	27.7	24.6
313576	5.8	38.6	26.2	23.4
313576	5.6	36.9	25.5	22.9
313576	5.7	39.5	27.8	24.2
313576	5.7	37.0	25.0	23.0
313576	5.1	33.7	25.8	22.7
Average	5.6	38.0	26.27	23.5
Greatest	5.9	42.2	27.9	24.6
Least	5.1	33.2	24.4	22.2

I have selected this as typical *cincinniformis* because it satisfies most nearly the figure in Martini-Chemnitz, which is the oldest figure. This also depicts the dark nucleus.

Reeve's figure represents a much broader race having a light nucleus. I have specimens satisfying this but as yet no definite locality connected with them. It will probably prove to be a distinct race, requiring a name. *Cochlostyla* (*Hypselostyla*) *cincinniformis cincinniformis* can be distinguished from the other forms by the dark bands, exceedingly broad and almost black, and when specimens are perfect the dark bands are beautifully mottled by hydrophanous lines. In some of the specimens the nuclear turns and the first postnuclear turns have a pinkish purplish tinge.

COCHLOSTYLA (HYPSELOSTYLA) CINCINNIFORMIS GUNTINGANA Bartsch

Plate 101, Figure 3

1932. *Cochlostyla* (*Hypselostylus*) *cincinniformis guntingana* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 338.

Shell elongate-ovate. Nuclear whorls white and sometimes brown. Postnuclear whorls covered with a thin periostracum, which may be of pale straw-color or tinged with brownish orange and which crosses the dark bands in axial hydrophanous lines. The postnuclear whorls are marked by three dark chocolate-brown zones: One at the summit, one at the periphery, and the other surrounding the umbilical area, the spaces between which may be straw-color or tinged with orange-brown. The interior of the aperture is bluish white, showing the external bands within. The peristome may be white or slightly tinged with brown. Nuclear whorls 2, well rounded, smooth except for incremental lines. Postnuclear whorls very slightly rounded and appressed at the summit, marked by feeble incremental lines and microscopic spiral striations on both spire and base. Periphery obsoletely angulated; base somewhat inflated, well rounded. Aperture subquadrate, oblique, outer lip slightly expanded and reflected. Columella rather slender, with a fold on its anterior third.

The type (U.S.N.M. no. 313574) was collected by me on the summit of Gunting Mountain, Loog Bay, Lubang Island. It has 5.3 whorls and measures: Length, 40 mm; greater diameter, 27.2 mm; lesser diameter, 24 mm.

A series of additional specimens yields the following measurements:

U.S.N.M. no.	Number of whorls	Length	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
313574	5. 3	40. 4	26. 7	24. 4
255789	5. 6	35. 5	26. 4	23. 4
255789	5. 1	37. 2	29. 3	25. 8
255789	5. 3	37. 2	26. 3	24. 2
255789	5. 5	36. 5	27. 0	23. 8
255789	5. 6	40. 5	26. 4	23. 9
255789	5. 5	36. 4	26. 3	24. 5
255789	5. 2	35. 2	25. 7	23. 3
255789	5. 6	39. 0	27. 0	24. 7
255789	5. 4	40. 2	29. 1	25. 2
255789	5. 8	40. 1	27. 7	24. 7
195392	5. 8	40. 2	28. 3	24. 8
195392	6. 0	41. 6	28. 6	26. 1
195392	5. 1	32. 3	24. 4	22. 3
20388	6. 0	40. 8	26. 6	24. 2
Average	5. 52	38. 2	27. 0	24. 35
Greatest	6. 0	41. 6	29. 3	26. 1
Least	5. 1	32. 3	24. 4	22. 3

The yellow or orange-yellow coloration of the light areas in this shell will distinguish it from the rest. It is interesting to find both dark tips and light tips, and I am somewhat at a loss to account for this. I visited Gunting Mountain on two succeeding days but combined all my collections, and there is just the possibility that we may have here a lumping of material that in reality represents two races. The dark and light nuclei usually speak for phylogenetic stocks, and the problem resulting therefrom had not presented itself at the time of collecting. The field naturalist is all too prone to overlook important features of this kind until he has had laboratory experience.

COCHLOSTYLA (HYPSELOSTYLA) CINCINNIFORMIS CABRASENSIS Bartsch

Plate 101, Figure 10

1932. *Cochlostyla* (*Hypselostylus*) *cincinniformis cabrasensis* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 338.

Shell very regularly conic, of white ground color with a narrow brown band making a feeble beginning on the second postnuclear whorl and increasing in width and intensity of coloration after this. Another brown band immediately posterior to the periphery begins at a similar place and also increases in strength and coloration with the increasing whorls. There is likewise a broad basal brown area about the columellar region. This and the peripheral band on the last turn are dark chocolate-brown, while the ones at the summit are somewhat paler. These bands are crossed by fine hydrophanous axial lines on the last turn. The interior of the aperture is bluish white, showing conspicuously the bands within, the basal region being dark, rendering the outer lip dark to its edge at that portion of the shell, the columella being white and the outer lip soiled white. Nuclear whorls 2, well rounded, marked by incremental lines. Postnuclear whorls almost flattened, marked by rather strong, retractively slanting, incremental lines and microscopic, closely spaced, spiral striations, which are present on both spire and base. Periphery feebly angulated; aperture oblique, subquadrate; outer lip thin, slightly reflected. Columella narrow, slightly excavated.

The type (U.S.N.M. no. 313639), collected by Quadras on Cabra Island, has 5.6 whorls and measures: Length, 43.2 mm; greater diameter, 30 mm; lesser diameter, 25.8 mm.

This is distinguished from the other subspecies by having the brown bands much brighter and the light areas intensely bluish white.

COCHLOSTYLA (HYPSELOSTYLA) CINCINNIFORMIS LUBANENSIS (Clench and Archer)

Plate 101, Figure 5

1841. *Helix cincinniformis* var. *a* Sowerby, Proc. Zool. Soc. London, 1841, pp. 17–18.

1851. *Bulimus cincinniformis* Deshayes, Férussac's Histoire naturelle . . . mollusques . . ., vol. 1, pp. 45–46 (in part), pl. 151, figs. 5, 6.

1912. *Cochlostyla cincinniformis* Möllendorff, Kobelt, and Winter, Semper's Reisen im Archipel der Philippinen, vol. 10, pp. 262–263 (in part), pl. 53, fig. 5.

1931. *Helicostyla cincinniformis lubanensis* Clench and Archer, Occ. Papers Boston Soc. Nat. Hist., vol. 5, pp. 334–335, pl. 17, fig. 1.

1932. *Cochlostyla* (*Hypselostylus*) *cincinniformis lubanensis* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 338.

Shell conic, covered by a pale straw-colored periostracum, which is usually worn off of the early whorl; when worn off of the later turns the substratum or shell proper is white. There is a moderately broad, more or less interrupted band at the summit of the postnuclear whorls and another at the periphery. These two bands are pale brown, and they are both interrupted by axial hydrophanous spots. There is no dark columellar area in this race. The interior of the aperture, the outer lip, and columella are white. Nuclear whorls 2, well rounded, forming a blunt apex. The postnuclear whorls are appressed at the summit, moderately rounded, and marked by retractively slanting lines of growth and fine, microscopic, closely spaced, spiral striations, which are present on both spire and base. The aperture is oblique, almost subquadrate; the outer lip is slightly expanded and reflected. The columella is slightly oblique, somewhat twisted, and slightly excavated.

A series of specimens before me yields the following measurements:

U.S.N.M. no.	Number of whorls	Length	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
313585	5.8	37.0	26.0	23.5
313585	5.4	34.0	25.8	23.2
313585	5.5	35.0	25.9	22.7
313585	5.5	35.5	26.8	22.9
313585	5.9	41.1	27.2	24.7
313585	5.5	36.0	25.8	23.1
313585	5.9	41.6	27.2	24.6
313585	5.5	37.8	26.3	23.5
313585	5.5	34.8	24.7	23.2
313585	5.4	36.5	26.3	23.0
313585	5.9	39.3	26.7	24.1
313585	5.5	38.0	26.8	24.6
313585	5.8	41.3	27.0	23.8
313585	5.8	39.5	27.3	24.8
313585	5.5	37.7	24.7	22.5
313585	5.9	27.9	26.2	23.2
313585	5.1	34.8	25.5	22.8
313585	5.2	35.6	24.7	22.3
313585	5.4	39.1	25.9	23.7
313585	5.2	33.7	24.7	22.9
313585	5.5	35.9	25.8	23.2
313585	6.0	39.6	25.7	23.5
313585	5.9	39.8	27.6	24.9
313585	6.1	41.6	26.6	24.5
313585	5.2	35.2	25.8	23.6
313585	5.9	40.8	27.0	22.9
313585	6.0	39.7	25.7	22.4
313586	5.8	41.6	27.2	24.9
313586	5.5	36.0	21.3	22.4
313586	5.6	38.5	25.5	23.4
313586	5.8	41.3	29.5	26.1
313586	5.8	40.1	27.9	24.9
313586	5.8	37.9	26.2	23.4
313586	5.7	41.2	27.9	25.2
313586	5.2	33.8	23.7	21.7
313586	6.0	45.0	30.8	27.5
313586	5.9	40.4	26.0	23.7
313586	5.7	38.7	26.5	23.7
313586	5.2	34.2	25.4	22.6

U.S.N.M. no.	Number of whorls	Length	Greater diameter	Lesser diameter
		Mm	Mm	Mm
313586	5. 7	38. 8	26. 4	24. 7
313586	5. 3	36. 5	26. 0	23. 3
313586	5. 6	39. 6	28. 2	24. 9
313586	5. 6	39. 1	29. 3	25. 5
313586	5. 6	37. 0	25. 0	23. 6
313586	5. 3	36. 0	25. 4	22. 3
195392	6. 0	44. 1	24. 1	27. 0
Average	5. 63	38. 0	26. 26	23. 8
Greatest	6. 1	45. 0	29. 5	27. 5
Least	5. 1	27. 9	21. 3	21. 7

Mr. de Mesa collected these specimens at Binacas, Lubang Island. Binacas is on the northwest coast of the island and about one-third of the distance from its northern end to the southern end, south of the northern end. Most of the other races so far known from this island have come from the east coast. It is remarkably uniform in shape and coloration. I take it that the albinos described by authors in the past have merely lost part of the hydrophanous color bands of the periostracum at the periphery and at the summit, a loss that would render them practically pure white. The absence of a dark umbilical area is a very characteristic feature of this race.

Subgenus EUDOXUS Albers

In this subgenus the shell is usually thin, ovate to ovate-conic, and covered by a very thin periostracum. The peristome varies from slightly to considerably expanded and reflected, and the columella is slightly excavated.

Type: *Cochlostyla* (*Eudoxus*) *effusa* (Pfeiffer).

COCHLOSTYLA (EUDOXUS) JONASI (Pfeiffer)

PLATE 101, FIGURE 7

1846. *Helix jonasi* PFEIFFER, Proc. Zool. Soc. London, 1845, p. 126.
1846. *Bulimus leai* PFEIFFER, Proc. Zool. Soc. London, 1846, p. 29.
1848. *Helix jonasi* PFEIFFER, Monographia heliceorum viventium, vol. 1, p. 225.
1848. *Bulimus leai* PFEIFFER, Monographia heliceorum viventium, vol. 2, p. 9.
1849. *Bulimus leai* REEVE, Conchologia iconica, pl. 12, fig. 66.
1850. *Helix jonasi* PFEIFFER, Martini-Chemnitz Conchylien Cabinet, ed. 2, vol. 1, Abt. 12, Theil 1, p. 298, pl. 50, figs. 5, 6.
1851. *Helix jonasi* REEVE, Conchologia iconica, pl. 26, fig. 113.
1853. *Bulimus leai* PFEIFFER, Monographia heliceorum viventium, vol. 3, p. 300.
1853. *Bulimus jonasi* PFEIFFER, *ibid.*, p. 172.
1855. *Helicostyla jonasi* H. and A. ADAMS, The genera of recent Mollusca, vol. 2, p. 192.
1856. *Bulimus leai* PFEIFFER, Malakozool. Blätter, vol. 2, p. 146.
1859. *Bulimus leai* PFEIFFER, Monographia heliceorum viventium, vol. 4, p. 361.
1859. *Helix jonasi* PFEIFFER, *ibid.*, p. 198.

1868. *Helix jonasi* PFEIFFER, Monographia heliceorum viventium, vol. 5, p. 267.
1868. *Bulimus leai* PFEIFFER, Monographia heliceorum viventium, vol. 6, p. 8.
1876. *Helix jonasi* PFEIFFER, Monographia heliceorum viventium, vol. 7, p. 578.
1877. *Cochlostyla jonasi* SEMPER, Reisen im Archipel der Philippinen, pt. 2, vol. 3, p. 188.
1877. *Cochlostyla leai* SEMPER, *ibid.*, pt. 2, vol. 3, p. 212.
1887. *Cochlostyla leai* HIDALGO, Journ. Conchyl., vol. 35, p. 152.
1887. *Cochlostyla jonasi* HIDALGO, *ibid.*, p. 189.
1892. *Cochlostyla leai* PILSBRY, Man. Conch., ser. 2, vol. 8, p. 32, pl. 17, figs. 33, 34.
1892. *Cochlostyla jonasi* PILSBRY, *ibid.*, pp. 32–33 (in part), pl. 17, figs. 32, 33; pl. 37, figs. 43, 44.
1895. *Helicostyla leai* PILSBRY, Man. Conch., ser. 2, vol. 9, p. 229.
1895. *Helicostyla jonasi* PILSBRY, *ibid.*, p. 229.
1896. *Cochlostyla leai* ELERA, Catalogo sistematico de toda la fauna de Filipinas, vol. 3, p. 603.
1896. *Cochlostyla jonasi* ELERA, *ibid.*, p. 603; in part.
1897. *Cochlostyla jonasi* HIDALGO, Journ. Conchyl., vol. 44, pp. 245, 257, 279, 290, 331, 332, 341, 347, 351.
1897. *Cochlostyla leai* HIDALGO, *ibid.*, pp. 292 (in part), 329, 338, 349, 350.
1898. *Cochlostyla jonasi* MÖLLENDORFF, Abh. Naturf. Ges. Görlitz, vol. 22, p. 131; in part.
1911. *Cochlostyla jonasi* MÖLLENDORFF, KOBELT, and WINTER, Semper's Reisen im Archipel der Philippinen, vol. 10, pt. 1, pp. 251–252 (in part), pl. 51, figs. 8, 8a.
1932. *Cochlostyla* (*Eudoxus*) *jonasi* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 338.

The shell is very broadly ovate, covered by a thin pale straw-colored periostracum. The early whorls are a little paler than the last. The interior of the aperture is bluish white, which is also the color of the peristome and columella. Nuclear whorls 2.1, strongly rounded and marked by rather coarse incremental lines and on the last half turn by fine spiral striations. The postnuclear whorls are somewhat inflated, well rounded, appressed at the summit, and marked by decidedly obliquely curved incremental lines, which on the appressed portion at the summit are very finely denticulated. In addition to this, the entire surface of the spire is marked by scarcely perceptible, closely spaced, microscopic, spiral striations. These I have been unable to observe on the base. Suture feebly constricted; periphery inflated, strongly rounded. Base short, strongly rounded with an impression at the insertion of the columella, which almost causes it to appear as if umbilicated. The aperture is subcircular; the outer lip is slightly expanded and reflected, while the columella is rather broad, somewhat excavated, terminating anteriorly in a denticle a little posterior to its junction with the outer lip. The columella is surrounded by a thin callus, which also extends over the parietal wall.

The specimen described and figured is one of two (U.S.N.M. no. 309459) that come from the Redfield collection, having probably been obtained from Cuming. It has 5.4 whorls and measures: Length, 33.7 mm; greater diameter, 28 mm; lesser diameter, 23.6 mm. The other specimen has also 5.4 whorls and measures: Length, 31.2 mm; greater diameter, 26.4 mm; lesser diameter, 22.4 mm.

There are two additional specimens in our collection collected by Cuming (U.S.N.M. no. 105285). They have 5 and 5.4 whorls and measure, respectively: Length, 31.1 and 30.3 mm; greater diameter, 27.3 and 24.4 mm; lesser diameter, 23.2 and 21.6 mm.

None of the specimens in our collection have a specific locality.

COCHLOSTYLA (EUDOXUS) BUSCHI (Pfeiffer)

Plate 101, Figure 9

1846. *Helix buschi* Pfeiffer, Proc. Zool. Soc. London, 1845, p. 126.
1848. *Helix buschi* Pfeiffer, Monographia heliceorum viventium, vol. 1, p. 226.
1849. *Bulimus albersi* Pfeiffer, Zeitschr. Malak., vol. 6, p. 86.
1850. *Helix buschi* Pfeiffer, Martini-Chemnitz Conchylien Cabinet, ed. 2, vol. 1, Abt. 12, Theil 1, p. 300, pl. 44, figs. 7, 8.
1850. *Bulimus albersi* Albers, Die Heliceen, ed. 1, p. 136.
1853. *Bulimus albersi* Pfeiffer, Monographia heliceorum viventium, vol. 3, p. 300; in part.
1855. *Helicostyla buschi* H. and A. Adams, The genera of recent Mollusca, vol. 2, p. 191.
1856. *Bulimus albersi* Pfeiffer, Malakozool. Blätter, vol. 2, p. 142.
1859. *Bulimus albersi* Pfeiffer, Monographia heliceorum viventium, vol. 4, p. 362; in part.
1860. *Cochlodryas albersi* Martens, Albers, Die Heliceen, ed. 2, p. 176.
1868. *Bulimus albersi* Pfeiffer, Monographia heliceorum viventium, vol. 6, p. 8; in part.
1877. *Bulimus albersi* Pfeiffer, Monographia heliceorum viventium, vol. 8, p. 10; in part.
1887. *Cochlostyla buschi* Hidalgo, Journ. Conchyl., vol. 35, p. 152; in part.
1892. *Cochlostyla jonasi* Pilsbry, Man. Conch., ser. 2, vol. 7, pl. 37. figs. 43, 44.
1892. *Cochlostyla jonasi* Pilsbry, Man. Conch., ser. 2, vol. 8, pp. 32–33; in part.
1895. *Helicostyla jonasi* Pilsbry, Man. Conch., ser. 2, vol. 9, p. 229; in part.
1896. *Eudoxus jonasi* Elera, Catalogo sistematico de toda la fauna de Filipinas, vol. 3, p. 603; in part.
1897. *Cochlostyla buschi* Hidalgo, Journ. Conchyl., vol. 44, pp. 253, 257, 262, 266, 306, 329, 331, 332, 338, 347, 350.
1898. *Cochlostyla buschi* Möllendorff, Abh. Naturf. Ges. Görlitz, vol. 22, p. 132; in part.
1901. *Cochlostyla buschi* Hidalgo, Obras malacologicas, pp. 483–485 (in part), pl. 87, fig. 5.
1911. *Cochlostyla* (*Phengus*) *jonasi* Möllendorff, Kobelt, and Winter, Semper's Reisen im Archipel der Philippinen, vol. 10, p. 256, pl. 52, figs. 8, 8a.
1932. *Cochlostyla* (*Eudoxus*) *buschi* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 338.

Shell elongate-ovate, covered with a pale lemon-yellow periostracum, which when removed leaves the shell a bluish white. The interior of aperture, peristome, and columella are bluish white. Nuclear whorls 2, well rounded, marked by incremental lines, and the last half of the last turn by fine spiral striations. The postnuclear whorls are moderately rounded, appressed at the summit, and marked by very fine retractively curved incremental lines and closely spaced microscopic spiral striations, which are present on both spire and base. The suture is moderately constricted; the periphery with an obsolete angle. The base is moderately long, somewhat inflated, and strongly rounded. The aperture is subcircular with the outer lip slightly expanded and reflected, and the columella is gently curved and rather narrow and without fold or tooth at the anterior end. The columellar wall and parietal wall are covered with a thin translucent callus.

The specimen described and figured (U.S.N.M. no. 309451) has 5.5 whorls and measures: Length, 34.6 mm; greater diameter, 24.2 mm; lesser diameter, 21.6 mm. It is from Mindoro, without specific locality.

Additional specimens yield the following data:

U.S.N.M. no.	Number of whorls	Length	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
309451	5. 4	31. 0	23. 5	21. 1
309451	5. 2	30. 2	24. 8	21. 2
309471	5. 4	29. 0	23. 2	20. 4
309415	5. 4	29. 7	21. 2	19. 3
309495	5. 5	35. 0	24. 0	21. 9
309495	5. 3	30. 1	22. 6	20. 3
99896	5. 5	31. 9	23. 3	21. 0
99896	5. 5	32. 1	24. 0	21. 3
99896	5. 2	30. 2	23. 2	21. 0
109363	5. 2	28. 2	22. 4	18. 9
20396	5. 5	34. 1	25. 8	22. 3
20396	5. 3	29. 2	20. 7	19. 3
Average	5. 37	30. 9	23. 22	20. 67
Greatest	5. 5	35. 0	25. 8	22. 3
Least	5. 2	28. 2	20. 7	18. 9

This species recalls *Cochlostyla* (*Eudoxus*) *jonasi*, but that is much stouter and has the columella toothed or notched at the anterior end.

COCHLOSTYLA (EUDOXUS) SIMPLEX (Jonas)

PLATE 101, FIGURE 6

1843. *Bulimus simplex* JONAS, Proc. Zool. Soc. London, 1842, p. 189.

1843. *Bulimus simplex* PHILIPPI, Abbildungen und Beschreibungen neuer oder wenig gekannter Conchylien, vol. 1, p. 53, pl. *Bulimus* 1, fig. 2.

1848. *Bulimus simplex* PFEIFFER, Monographia heliceorum viventium, vol. 2, p. 11.

1848. *Bulimus simplex* REEVE, Conchologia iconica, pl. 12, fig. 63.

1850. *Eudoxus simplex* ALBERS, Die Heliceen, ed. 1, p. 137.

1853. *Bulimus simplex* PFEIFFER, Monographia heliceorum viventium, vol. 3, p. 300.

1855. *Bulimus simplex* PFEIFFER, Martini-Chemnitz Conchylien Cabinet, ed. 2, vol. 1, Abt. 13, Theil 1, pp. 181–182, pl. 53, figs. 8, 9.
1856. *Bulimus simplex* PFEIFFER, Malakozool. Blätter, vol. 2, p. 147.
1859. *Bulimus simplex* PFEIFFER, Monographia heliceorum viventium, vol. 4, p. 362.
1860. *Phengus simplex* MARTENS, Albers, Die Heliceen, ed. 2, p. 180.
1868. *Cochlostyla simplex* PFEIFFER, Monographia heliceorum viventium, vol. 6, p. 8.
1874. *Cochlostyla simplex* SEMPER, Reisen im Archipel der Philippinen, pt. 2, vol. 3, p. 218.
1877. *Bulimus simplex* PFEIFFER, Monographia heliceorum viventium, vol. 8, p. 10.
1887. *Cochlostyla simplex* HIDALGO, Journ. Conchyl., vol. 35, p. 177; in part.
1892. *Cochlostyla simplex* PILSBRY, Man. Conch., ser. 2, vol. 8, pp. 33–34, pl. 8, figs. 48, 49, 52.
1895. *Helicostyla simplex* PILSBRY, Man. Conch., ser. 2, vol. 9, p. 229.
1897. *Cochlostyla simplex* HIDALGO, Journ. Conchyl., vol. 44, pp. 315, 331, 332, 341, 347, 348, 350, 352.
1898. *Cochlostyla simplex* MÖLLENDORFF, Abh. Naturf. Ges. Görlitz, vol. 22, p. 131; in part.
1901. *Cochlostyla simplex* HIDALGO, Obras malacologicas, p. 523 (in part), pl. 73, fig. 2.
1911. *Cochlostyla simplex* MÖLLENDORFF, KOBELT, and WINTER, Semper's Reisen im Archipel der Philippinen, vol. 10, pp. 252–254 (in part), pl. 51, figs. 1, 1a.
1932. *Cochlostyla* (*Eudoxus*) *simplex* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 338.

Shell small, ovate, the early whorls white, the last one with a grayish-olive tinge, more intense on the base. Interior of the aperture, peristome, and columella white. The periostracum is exceedingly thin. Nuclear whorls 1.6, strongly rounded, smooth, forming an almost pointed apex, marked by lines of growth only. The postnuclear whorls are strongly rounded, the last one decidedly inflated, appressed at the summit, and marked by rather rough threadlike lines of growth and numerous microscopic, closely spaced, spiral striations, which are present on both spire and base. Suture moderately constricted; periphery obsoletely angulated, at least the more intense coloration of the base and the sharp termination thereof at the periphery give one the impression of an obsolete angle. Aperture broadly ovate, slightly oblique; outer lip thin, expanded, and reflected. The columella is narrow, with a faint thread a little posterior at the junction of the columella with the outer lip.

There are three specimens from the Redfield collection (U.S.N.M. no. 309465) collected on Mindoro, one of which I have described and figured; one specimen (U.S.N.M. no. 313602) collected by Quadras; four specimens (U.S.N.M. no. 20389) collected by the Exploring Expedition, probably at the southern tip of Mindoro. These yield the following data:

U.S.N.M. no.	Number of whorls	Length	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
309465	5. 3	27. 5	19. 0	17. 5
309465	5. 5	28. 3	19. 7	17. 8
309465	5. 4	28. 0	18. 9	17. 5
313602	5. 4	27. 9	19. 1	17. 5
20389	5. 5	30. 2	20. 3	18. 0
20389	5. 6	28. 5	18. 6	17. 4
20389	5. 1	26. 2	19. 4	17. 4
20389	5. 2	24. 8	17. 8	15. 7
Average	5. 37	27. 6	19. 0	17. 3
Greatest	5. 6	30. 2	20. 3	18. 0
Least	5. 1	24. 8	17. 8	15. 7

This subspecies is nearest related to shells that have been listed under the same name from the Island of Romblon. The Romblon shell, however, is in every way larger, heavier, and with more intense green coloration and should be differentiated from the Mindoro specimens. The huge series of these before me collected on the Menage Expedition easily shows the need for its separation. I therefore give to it the name *Cochlostyla* (*Eudoxus*) *steerei*.

COCHLOSTYLA (EUDOXUS) ALBINA (Grateloup)

Plate 101, Figure 4

1840. *Bulimus albinus* Grateloup, Actes Soc. Linn. Bordeaux, vol. 11, pp. 166, 417, pl. 3, fig. 24.
1841. *Bulinus bullula* Broderip, Proc. Zool. Soc. London, 1840, p. 159.
1842. *Bulimus bullula* Pfeiffer, Symbolae, vol. 2, p. 44.
1843. *Bulimus bullula* Philippi, Abbildungen und Beschreibungen neuer oder wenig gekannter Conchylien, p. 53, pl. *Bulimus* 1, fig. 1.
1848. *Bulimus bullula* Pfeiffer, Monographia heliceorum viventium, vol. 2, p. 10; in part.
1850. *Eudoxus bullula* Albers, Die Heliceen, ed. 1, p. 137.
1851. *Bulimus bullula* Reeve, Conchologia iconica, pl. 12, fig. 68.
1853. *Bulimus bullula* Pfeiffer, Monographia heliceorum viventium, vol. 3, p. 398.
1856. *Bulimus* (*Eudoxus*) *bullula* Pfeiffer, Malakozool. Blätter, vol. 2, p. 146.
1868. *Bulimus bullula* Pfeiffer, Monographia heliceorum viventium, vol. 5, p. 7.
1872. *Cochlostyla bullula* Martens, Malakozool. Blätter, vol. 20, p. 180.
1877. *Cochlostyla bullula* Semper, Reisen im Archipel der Philippinen, pt. 2, vol. 3, p. 218; in part.
1877. *Bulimus bullula* Pfeiffer, Monographia heliceorum viventium, vol. 8, p. 8; in part.
1887. *Cochlostyla bullula* Hidalgo, Journ. Conchyl., vol. 35, pp. 156–157.
1890. *Cochlostyla virginea* Pilsbry, Man. Conch., ser. 2, vol. 6, pp. 36–37 (in part), pl. 7, figs. 31–34.
1895. *Helicostyla virginea* Pilsbry, Man. Conch., ser. 2, vol. 9, p. 229.
1896. *Helicostyla virginea* Elera, Catalogo sistematico de toda la fauna de Filipinas, vol. 3, pp. 604–605; in part.
1897. *Cochlostyla albina* Hidalgo, Journ. Conchyl., vol. 44, pp. 247, 262.

1898. *Helicostyla virginea* MÖLLENDORFF, Abh. Naturf. Ges. Görlitz, vol. 22, p. 132; in part.

1901. *Cochlostyla virginea* HIDALGO, Obras malacologicas, pp. 486–487; in part.

1912. *Helicostyla virginea* MÖLLENDORFF, KOBELT, and WINTER, Semper's Reisen im Archipel der Philippinen, vol. 10, p. 257; in part.

1932. *Cochlostyla* (*Eudoxus*) *albina* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 338.

1933. *Helicostyla* (*Eudoxus*) *virginea* CLENCH and ARCHER, Papers Michigan Acad. Sci., Arts, Letters, vol. 17, p. 544; in part.

Shell regularly ovate, thin, bluish white, with a pale bluish-green tinge on the base. There is a slender white line immediately at the summit of the shell, marking the appressed portion of the summit. Nuclear whorls 2, strongly rounded, smooth, forming a conical apex. marked by incremental lines and on the last half by fine spiral striations. The postnuclear whorls are rather high between the summit and suture and moderately well curved and marked by feeble lines of growth and microscopic spiral striations, which are present on both spire and base, although they are scarcely perceptible on the base. Suture slightly constricted; periphery of the last whorl inflated and well rounded. The base is rather long, somewhat inflated, evenly rounded. Aperture oval, oblique; the outer lip scarcely at all expanded or reflected. There is the merest trace of a curl shown. The inner lip or columella is also exceedingly narrow and threadlike, passing without interruption in an even curve into the basal lip. The columellar area and parietal wall are covered by a thin whitish callus.

The specimen described and figured (U.S.N.M. no. 255828), collected by Col. Edgar A. Mearns on the Mount Halcon Expedition in Mindoro, has 4.5 whorls and measures: Length, 34.3 mm; greater diameter, 24.2 mm; less diameter, 20.6 mm.

U.S.N.M. no.	Number of whorls	Length	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
106404	5.0	32.4	21.7	19.3
106404	4.8	29.8	21.8	19.0
106404	4.6	33.2	22.7	20.1
106404	4.6	32.2	22.6	19.8
106404	4.6	31.8	21.8	19.4
106404	4.6	30.0	22.8	19.7
106404	4.6	32.0	22.4	20.0
106404	4.8	33.7	22.7	20.0
195398	4.8	35.5	25.3	21.6
195398	5.1	34.0	22.8	20.7
195398	5.1	35.8	24.0	21.2
195398	5.0	33.0	22.0	19.3
195398	5.0	34.8	22.4	20.0
309446	5.1	35.8	24.8	21.4
309446	4.9	31.8	22.3	20.0
313642	5.0	35.9	23.7	21.0
313642	5.4	35.8	22.0	19.6
313642	4.8	32.7	22.3	19.8

The United States National Museum collection contains the following specimens of this species: Eight (U.S.N.M. no. 106404), two of which were collected by Cuming; five (U.S.N.M. no. 195398) from the von Möllendorff collection from Mindoro; two (U.S.N.M. no. 309446) collected by Schmacker in Mindoro; three (U.S.N.M. no. 313642) collected by Juan Antonio in Mindoro. These yield the measurements given in the foregoing table.

This species is readily distinguishable from *Cochlostyla* (*Eudoxus*) *simplex* by its much larger size, more ovate shape, and much more oval aperture.

COCHLOSTYLA (EUDOXUS) CANONIZADOI Bartsch

PLATE 101, FIGURE 8

1932. *Cochlostyla* (*Eudoxus*) *canonizadoi* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 338.

Shell helicoid, rather elevated with a broadly conic spire. The spire is milk white. Base with a pale greenish tinge. Interior of aperture and peristome white. Nuclear whorls 1.5, marked by incremental lines, which are a little stronger on the last portion of the last turn than on the rest. Postnuclear whorls inflated, well rounded, appressed at the summit, and marked by incremental lines and feebly incised spiral striations. Suture moderately impressed. Periphery of the last whorl inflated, feebly angulated. The base is short, inflated, and strongly rounded. Aperture very broadly ovate, almost subcircular. The peristome is broadly expanded and reflected. The inner lip is expanded and reflected and is adnate to the base except at the extreme tip. The parietal wall is glazed with a moderately thick callus.

U.S.N.M. no. 313723 contains 16 topotypes, which measure:

Number of whorls	Length	Greater diameter	Lesser diameter
	Mm	*Mm*	*Mm*
5.0	28.9	27.5	24.1
5.0	26.1	28.6	24.8
5.0	26.5	25.3	22.7
5.0	25.3	26.8	22.0
5.0	25.1	25.9	22.1
4.9	22.8	23.8	20.0
5.0	25.8	27.4	22.5
5.0	22.6	23.8	20.4
4.7	22.8	26.0	21.4
4.8	22.7	23.2	20.0
5.1	29.1	28.8	25.7
4.9	26.2	24.7	21.7
5.0	25.0	26.9	23.1
4.9	24.9	25.8	21.6
4.6	22.3	23.3	21.7
4.7	22.7	24.1	20.7

The type (U.S.N.M. no. 313722), collected on Sibolon Island by Mr. Canonizado, has 5 whorls and measures: Length, 27.3 mm; greater diameter, 27.9 mm; lesser diameter, 22.5 mm.

This species strongly suggests *Cochlostyla* (*Cochlodryas*) *halichlora* Semper, from Luzon, but is in every way much smaller.

Subgenus PROCHILUS Albers

In this subgenus the shell is of small to medium size, of ovate, elongate-ovate, or ovate-conic form, and covered with a thin shining periostracum, which may or may not be hydrophanous. The base is usually narrowly perforated, although often the perforation is covered by the reflection of the inner lip. The peristome is broadly expanded, thickened, and reflected.

Type: *Cochlostyla* (*Prochilus*) *virgata* (Jay).

THE COCHLOSTYLA (PROCHILUS) VIRGATA (JAY) COMPLEX

Here and there, the world over, the field naturalist meets with problems of a most puzzling character. While in most instances he finds that organisms belonging to what we call a species reproduce themselves with their definite characters so faithfully that they are as easily recognized as the coins of a modern realm, nevertheless he now and then meets with an assemblage of specimens that occupy a definite habitat but, while they have certain characters in common that have caused naturalists to assign them as a species to a particular genus, present such an enormous range of variations that it is difficult to find two individuals exactly alike. Not infrequently he even finds individuals among such a group that might be assigned to a widely different species, if general resemblance only were considered.

Long ago groups of this kind were said to be in a state of flux, and more recently they have been said to be mutating, and the individual variants have been called mutants. Speculations as to the origin of these mutants have been many, and the literature of today is still filled with diverse concepts of this problem.

Personally, I believe that my *Cerion* breeding experiments have shed considerable light on the molluscan phase of mutants. Crossing *Cerion viaregis* Bartsch with *Cerion incanum* Binney produced in the F^1 generation offspring that fused in shell characters the features of the two parents, while the F^2 generation produced an endless array of mutants, varying enormously in size, color, sculpture, the structure of the soft anatomy, in fact, simply running riot as far as variation is concerned. Here then we have an explanation of a source of mutation.

What I have said regarding the *Cerion viaregis* and *Cerion incanum* hybridization experiments is duplicated in the field on the north coast of Cuba between Habana and Matanzas, where at the west end of a certain stretch of coast line *Cerion tridentata* Pilsbry and Vanatta occurs and at the east end for a mile or more *Cerion peracuta* Torre. Here the same story of mutation applies, and I know a number of additional mutating colonies of Cerions in the Bahamas and Cuba. It is also true of *Vivipara* in Lake Lanao, Mindanao, Philippine Islands, and of at least four species of marine mollusks of the family Pyramidellidae in United States waters, as well as of the mollusks here under discussion.

Cochlostyla (*Prochilus*) *virgata* (Jay), as our synonymy shows, has been rechristened many times, and it is not surprising that this should have been the case. Isolated specimens reaching museum men unaware of the mutating condition of this complex would, on account of the great difference they displayed when compared with allied described species, be subjected to naming. It is only when a mass of material, such as lies before me, has been assembled or when in the field one finds that these mutants are produced in a single laying of a parent that their true inwardness becomes revealed. There is now no more excuse for holding them distinct species than there would be justification to give specific rank to all the horticultural varieties of chrysanthemums and dahlias displayed annually in our flower exhibits.

What the progenitors of *Cochlostyla* (*Prochilus*) *virgata* (Jay) may have been is a vital question, but opinions expressed at the present must be looked upon as mere conjectures. The recurrence of certain elements suggests an affinity with *Cochlostyla* (*Prochilus*) *cuyoensis* (Pfeiffer), whose races are found on the islands to the south and southeast of Mindoro. Certain other features, such as hydrophanous fulgurations of the periostracum, as well as the general coloration, suggest some members of the *Cochlostyla* (*Chrysallis*) *aspersa mindoroensis* (Broderip) complex, while still others suggest the small, plain yellow, thick-shelled *Cochlostyla* (*Prochilus*) *cerina* Bartsch, which appears to be common in southeastern Mindoro. It is possible that this has contributed the yellow element in our mutating complex.

An examination of the soft anatomy of these creatures, which I hope shortly to be able to make through the kindness of Mr. de Mesa, may throw additional light upon our problem.

COCHLOSTYLA (PROCHILUS) VIRGATA (Jay)

Plates 102–105

1839. *Bulimus virgatus* Jay, Catalogue of recent shells in the cabinet of John C. Jay, p. 120, pl. 6, fig. 4.
1839. *Bulimus porraceus* Jay, *ibid.*, p. 120, pl. 6, fig. 5.
1840. *Bulimus labrella* Grateloup, Actes Soc. Linn. Bordeaux, vol. 11, p. 165.
1840. *Partula labrella* Grateloup, *ibid.*, pp. 423–424, pl. 4, fig. 6.
1841. *Bulinus dryas* Broderip, Proc. Zool. Soc. London, 1840, pp. 94–95.
1841. *Bulinus sylvanus* Broderip, *ibid.*, p. 95.
1842. *Bulinus virgatus* Sowerby, The conchological illustrations, p. 8, p. 186, figs. 112–114.

1842. *Bulimus virgatus* Pfeiffer, Symbolae, vol. 2, p. 125.
1842. *Bulimus dryas* Pfeiffer, *ibid.*, p. 44.
1842. *Bulimus sylvanus* Pfeiffer, *ibid.*, p. 51.
1843. *Bulimus calobaptus* Jonas, Proc. Zool. Soc. London, 1842, p. 188.
1843. *Bulimus calobapta* Philippi, Abbildungen und Beschreibungen neuer oder wenig gekannter Conchylien, p. 54, pl. 1, fig. 6.
1848. *Bulimus virgatus* Pfeiffer, Monographia heliceorum viventium, vol. 2, pp. 40–41; in part.
1848. *Bulimus dryas* Pfeiffer, *ibid.*, pp. 41–42; in part.
1848. *Bulimus calobapta* Pfeiffer, *ibid.*, p. 42.
1850. *Amphidromus calobapta* Albers, Die Heliceen, ed. 1, p. 139.
1850. *Amphidromus virgatus* Albers, *ibid.*, p. 139.
1850. *Bulimus dryas* Albers, *ibid.*, p. 140.
1851. *Bulimus cuyoensis* Reeve, Conchologia iconica, pl. 9, figs. 43a, 43b; list in part, not the figures.
1851. *Bulimus dryas* Reeve, *ibid.*, pl. 9, figs. 45a–c.
1851. *Bulimus virgatus* Reeve, *ibid.*, pl. 9, figs. 46a–c.
1851. *Bulimus dryas* Deshayes, Férussac's Histoire naturelle . . . mollusques . . ., vol. 2, pt. 2, p. 61, pl. 111, figs. 3–7.
1851. *Bulimus calobaptus* Deshayes, *ibid.*, pp. 57–58; in part.
1851. *Bulimus virgatus* Deshayes, *ibid.*, pp. 62–63, pl. 111, figs. 3–7.
1853. *Bulimus virgatus* Pfeiffer, Monographia heliceorum viventium, vol. 3, p. 40; in part.
1853. *Bulimus dryas* Pfeiffer, *ibid.*, p. 323.
1853. *Bulimus calobaptus* Pfeiffer, *ibid.*, p. 326; in part.
1855. *Bulimus calobapta* Pfeiffer, Martini–Chemnitz Conchylien Cabinet, ed. 2, vol. 1, Abt. 13, Theil 1, p. 116, pl. 35, figs. 11–14.
1856. *Bulimus* (*Amphidromus*) *dryas* Pfeiffer, Malakozool. Blätter, vol. 2, p. 147.
1856. *Bulimus* (*Amphidromus*) *virgatus* Pfeiffer, *ibid.*, p. 147.
1856. *Amphidromus calobaptus* Pfeiffer, *ibid.*, p. 147.
1859. *Bulimus virgatus* Pfeiffer, Monographia heliceorum viventium, vol. 4, p. 382; in part.
1859. *Bulimus dryas* Pfeiffer, *ibid.*, p. 382.
1859. *Bulimus calobaptus* Pfeiffer, *ibid.*, p. 384; in part.
1860. *Prochilus calobaptus* Martens, Albers, Die Heliceen, ed. 2, p. 179.
1860. *Prochilus virgata* Martens, *ibid.*, p. 179.
1860. *Prochilus dryas* Martens, *ibid.*, p. 179.
1868. *Prochilus virgatus* Pfeiffer, Monographia heliceorum viventium, vol. 6, p. 28; in part.
1868. *Bulimus dryas* Pfeiffer, *ibid.*, p. 28.
1868. *Bulimus calobaptus* Pfeiffer, *ibid.*, p. 29; in part.
1877. *Cochlostyla virgata* Semper, Reisen im Archipel der Philippinen, pt. 2, vol. 3, p. 221.
1877. *Cochlostyla dryas* Semper, *ibid.*, p. 221.
1877. *Cochlostyla calobapta* Semper, *ibid.*, p. 221.
1877. *Cochlostyla sylvanoides* Semper, *ibid.*, p. 222, pl. 10, fig. 4.
1877. *Bulimus dryas* Pfeiffer, Monographia heliceorum viventium, vol. 8, p. 42.
1877. *Bulimus calobaptus* Pfeiffer, *ibid.*, p. 46; in part.
1877. *Bulimus virgatus* Pfeiffer, *ibid.*, p. 42; in part.
1887. *Cochlostyla calobapta* Hidalgo, Journ. Conchyl., vol. 35, pp. 174–175; in part.
1887. *Cochlostyla virgata* Hidalgo, *ibid.*, p. 181.

1892. *Cochlostyla calobapta* Pilsbry, Man. Conch., ser. 2, vol. 8, pp. 46–47 (in part), pl. 15, fig. 7.
1892. *Cochlostyla virgata sylvanoides* Pilsbry, *ibid.*, pp. 48–49, pl. 16, fig. 11; pl. 17, fig. 37.
1892. *Cochlostyla dryas* Pilsbry, *ibid.*, p. 49, pl. 16, figs. 18, 19, 25.
1892. *Cochlostyla virgata porracea* Pilsbry, *ibid.*, p. 48, pl. 17, fig. 36.
1892. *Cochlostyla virgata* Pilsbry, *ibid.*, pp. 48–49, pl. 16, figs. 11–15; pl. 17, fig. 35.
1892. *Cochlostyla virgata pulchrior* Pilsbry, *ibid.*, p. 49, pl. 16, figs. 12, 13.
1895. *Helicostyla calobapta* Pilsbry, Man. Conch., ser. 2, vol. 9, p. 231; in part.
1895. *Helicostyla porracea* Pilsbry, *ibid.*, p. 231.
1895. *Helicostyla virgata* Pilsbry, *ibid.*, p. 231.
1895. *Helicostyla virgata sylvanoides* Pilsbry, *ibid.*, p. 231.
1895. *Helicostyla dryas* Pilsbry, *ibid.*, p. 231.
1895. *Helicostyla virgata pulchrior* Pilsbry, *ibid.*, p. 231.
1896. *Prochilus calobapta* Elera, Catalogo sistematico de toda la fauna de Filipinas, vol. 3, p. 609; in part.
1896. *Cochlostyla virgata* Elera, *ibid.*, pp. 609–610.
1896. *Cochlostyla virgata porracea* Elera, *ibid.*, p. 610.
1896. *Cochlostyla virgata pulchrior* Elera, *ibid.*, p. 610; in part.
1896. *Cochlostyla dryas* Elera, *ibid.*, p. 610.
1897. *Cochlostyla virgata* Hidalgo, Journ. Conchyl, vol. 44, pp. 246, 247, 248, 254, 256, 259, 291, 319, 324, 331, 341, 350.
1898. *Cochlostyla calobapta* Möllendorff, Abh. Naturf. Ges. Görlitz, vol. 22, p. 144; in part.
1898. *Cochlostyla virgata* Möllendorff, *ibid.*, p. 145; in part.
1898. *Cochlostyla virgata alampe* Möllendorff, *ibid.*, p. 145; *nomen nudum.*
1898. *Helicostyla virgata sylvanoides* Möllendorff, *ibid.*, p. 145.
1898. *Cochlostyla dryas* Möllendorff, *ibid.*, p. 146; in part.
1901. *Cochlostyla porracea* Hidalgo, Obras malacologicas, pt. 1, p. 504 (in part); pp. 504–507, pl. 82, figs. 1–8; pl. 98, figs. 4–7; pl. 127, fig. 6.
1901. *Cochlostyla virgata* Hidalgo, *ibid.*, pp. 509–511 (in part), pl. 94, figs. 1–7.
1901. *Cochlostyla calobapta* Hidalgo, *ibid.*, pp. 512–513 (in part), pl. 127, fig. 5(?).
1914. *Cochlostyla* (*Prochilus*) *calobapta* Möllendorff, Kobelt, and Winter, Semper's Reisen im Archipel der Philippinen, vol. 10, pp. 322–324; in part.
1914. *Cochlostyla* (*Prochilus*) *virgata* Möllendorff, Kobelt, and Winter, *ibid.*, pp. 322–324, pl. 72, figs. 3–14.
1914. *Helicostyla virgata sylvanoides* Möllendorff, Kobelt, and Winter, *ibid.*, p. 329, pl. 74, figs. 1, 2.
1914. *Cochlostyla virgata alampe* Möllendorff, Kobert, and Winter, *ibid.*, p. 330.
1914. *Cochlostyla dryas* Möllendorff, Kobelt, and Winter, *ibid.*, pp. 330–331, pl. 74, figs. 8–10.
1914. *Cochlostyla dryas porracea* Möllendorff, Kobelt, and Winter, *ibid.*, p. 331, pl. 77, figs. 1–6.
1932. *Cochlostyla* (*Prochilus*) *virgata* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 338.
1932. *Helicostyla virgata maxwellsmithi* McGinty, Nautilus, vol. 46, p. 65, pl. 4, fig. 8.
1933. *Helicostyla* (*Prochilus*) *virgata* Clench and Archer, Papers Michigan Acad. Sci., Arts, Letters vol. 17, p. 543.
1933. *Helicostyla* (*Prochilus*) *virgata pulchrior* Clench and Archer, *ibid.*, p. 543.
1933. *Helicostyla* (*Prochilus*) *virgata porracea* Clench and Archer, *ibid.*, p. 543.

In *Cochlostyla* (*Prochilus*) *virgata* (Jay) the shell varies enormously in size and shape; it may be elongate-conic or elongate-ovate, slender or gibbose. The whorls may be slightly rounded or inflated. The suture ranges from poorly defined to strongly impressed. The periphery may show indications of an angulation or it may be inflated and well rounded. The base may be short and inflated and well rounded or produced and but slightly rounded. The aperture may vary from oval to subquadrate; the outer lip may be slightly expanded and reflected or broadly expanded and decidedly reflected and even thickened; the columella may be slender or broadly expanded at its insertion and reflected and appressed to the base without leaving an umbilical chink, or a slight umbilicus may be present. The parietal wall may be covered by a mere film of callus, or the callus may be so thickened as to join the posterior angle of the aperture with the columella. The nuclear whorls may be light or dark or intermediate. The postnuclear whorls are covered by a hydrophanous periostracum, which also presents great variation in coloration. It may be pale yellow or orange tinted or olivaceous or even brownish. The hydrophanous lines may be narrow, broad, or even fulgurated, vertical, protracted, or retracted. The shell itself, when the periostracum is removed, may be unicolor, bluish white, flesh colored, pale yellow, olivaceous, pale brown, dark brown, or purple-brown; varicial streaks may be present; or the shell may be variously banded with zones of brown and yellow, varying materially in width. The interior of the aperture is bluish white, sometimes more intensely bluish than at others. The peristome is usually of the same color, but in some of the forms it is edged with buff, brown, or purple. The nuclear whorls are well rounded and form a more or less pointed apex. They are smooth, except for lines of growth and the last portion of the last turn, which shows the beginning of fine spiral striations. The postnuclear whorls also show retractively slanting lines of growth, which in some individuals amount almost to threadlike riblets, and the strength of spiral striations on spire and base also shows considerable variation. There seems scarcely any limit to the degree of variation in the shape and color pattern, and some idea of the range of variation can be obtained by an examination of plates (unfortunately not in color).

On plate 102 I have copied 12 figures representing previously named shells that are now referred here. Figures 1, 5, and 9 represent *Bulinus sylvanus* Broderip as figured by Reeve in his Conchologia Iconica on plate 9, figures 46a, b, and c. Figures 1 and 2 represent Pilsbry's *Cochlostyla* (*Prochilus*) *pulchrior*, as figured on his plate 16, figures 12 and 13, figure 1 being a copy of one of the specimens of Reeve's *sylvanus.* Figure 3 is a copy of Jay's *Bulimus porraceus*, figured in Jay's Catalogue, plate 6, figure 5. Figure 4 is a copy of

Jay's *Bulimus virgatus*. Figure 6 is a copy of Grateloup's figure of *Partula labrella*, published in the Actes de la Société Linnéenne de Bordeaux, vol. 11, plate 4, figure 6. Figure 7 is a copy of Semper's *Cochlostyla sylvanoides*, published on plate 10, figure 4, of his Reisen im Archipel der Philippinen, pt. 2, vol. 3. Figure 8 is a copy of *calobaptus* Jonas as figured by Philippi in his Abbildungen und Beschreibungen neuer oder wenig gekannter Conchylien, on plate 1 of *Bulimus*, figure 6. Figures 10, 11, and 12 represent *Bulinus dryas* Broderip as figured by Reeve in his Conchologia Iconica, on plate 9, figures 45a–c. All these I consider belong here.

I give three additional plates to show range of variation:

In plate 103, the ground color consists of various shades of yellow. Figure 7 is unicolor without a dark umbilical blotch or spot. It, however, shows faint fulgurations on the early whorls. Figure 11 shows a very slender unicolor form with a heavy and broadly expanded lip. Figure 10 also is unicolor, but here we have a pale brown edging to the peristome. Figure 12 likewise is unicolor but differs markedly in shape. Figure 6 is unicolor but stands intermediate in shape between figure 12 and the usual form. Figure 4 is unicolor with the outer lip and columella broadly expanded and thickened. Figure 8 is unicolor, except for marked fulgurations, but has the umbilical dark area. Figure 9 is unicolor and more olivaceous than those preceding. It has a faint umbilical dark area and an indication of a peripheral zone. Figure 3 is markedly fulgurated with a peripheral brown band and an umbilical patch of brown. Figure 5 has a purplish-brown band at the summit and the peristome edged with the same color. There is also an umbilical dark area of the same or a little darker tint. Figure 2 has a dark band at the summit, a dark band at the periphery, a dark area at the umbilicus, and a dark edging to the entire peristome. Figure 1 has the early nuclear whorls light, succeeded by cloudy-brown whorls, which in turn are followed by an orange-yellow one, the last whorl having a light peripheral band.

All the shells pictured on plate 103 have light nuclear tips with the exception of figure 3, in which they are dark. To show how varied these shells are in the same locality, I need but draw attention to the fact that plate 103, figures 3 and 7, plate 104, figures 1, 2, 3, and 6, and plate 105, figures 2 and 8, come from Ariod, Calapan, while plate 103, figures 9 and 12, plate 104, figure 10, and plate 12, figure 4, come from Calapan.

In plate 104 the ground color ranges from orange-red to bright chestnut-brown. The nuclear whorls in figures 1, 5, 7, and 9 are white; in the rest they are dark. The periostracum is fulgurated in varying degrees with hydrophanous bands of varying widths and distribution. Here, as in plate 103, the interior of the aperture and peristome are bluish white. In figures 1, 2, 3, 8, 10, 11, and 12 the peristome is edged with brown. Figure 4 has a very dark brown peripheral band and a dark brown columellar patch. In figure 6 a brown columellar patch is present, and the peripheral band is merely indicated. Figure 11 has both peripheral band and columellar patch, while in figure 12 they are merely indicated.

In plate 105 the ground color again varies from orange-red to brown. In this group the shells are all conspicuously spirally banded, the bands varying from narrow to broad and ranging from pale orange-brown to dark brown. The periostracum is again either plain or fulgurated. Figures 8, 9, 10, and 11 are light tipped; the rest are dark tipped. In figure 4 we have a reversal of the usual coloration, and the umbilical area is light instead of dark. In figure 1 there is a similar indication, although here the umbilical area is pale orange-yellow. Likewise in figures 2, 5, and 10. In figures 6, 7, 9, 11, and 12 the umbilical area is dark. The rest of the color phases are so well shown in our figures that there is no need of further explanation. I wish only to emphasize that in this mutating complex there is a remarkable range of variation.

COCHLOSTYLA (PROCHILUS) species?

PLATE 107, FIGURES 11–16

A scant collection of shells, suggesting *Cochlostyla* (*Prochilus*) *virgata* but with white or pale yellow periostracum, unicolor or banded with heavy and broadly reflected lip, is before me. They come from southern Mindoro, some from Bongabon, Bulalacao, and Mangarin, and some collected by the Exploring Expedition from Ilin Island.

When more specimens with definite locality labels come to hand we may have to resurrect *Cochlostyla* (*Prochilus*) *dryas* Broderip and consider it as a distinct species, probably with several zoogeographic races. Until then, however, the matter entails too many guesses to be so treated, and I prefer to pass it over for the time being. Attention should be called, however, to Broderip's statement in the Proceedings of the Zoological Society of London, 1841, page 95, that "Mr. Cuming informs us that the animal of this elegant shell * * * (*Cochlostyla* (*Prochilus*) *dryas*) was ash colored, darker above." On the same page he says of *Cochlostyla* (*Prochilus*) *sylvanus* that "Mr. Cuming informs us that the animal is reddish brown." *Cochlostyla* (*Prochilus*) *dryas* was reported by Broderip as coming from Mansalay, which would put it within the range of the present element.

The specimens shown on plate 106, figures 13 and 14, come from Bulalacao; figures 7, 11, and 12 from Mangarin.

COCHLOSTYLA (PROCHILUS) CERINA Bartsch

PLATE 107, FIGURE 9

1932. *Cochlostyla* (*Prochilus*) *cerina* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 338.

Shell of medium size, very elongate-ovate. Nuclear whorls pale buff. Postnuclear whorls yellow with an olivaceous tinge. Occasional varicial streaks of darker shades are present. The coloration appears to be solely confined to the periostracum, for where this is removed the shell appears white below. There is a narrow light zone at the summit. Interior of aperture, expanded peristome, and columella bluish white. Nuclear whorls 2.5, forming a rather pointed spire. Postnuclear whorls slightly rounded, appressed at the summit, marked by retractively slanting lines of growth and closely approximated microscopic spiral striations, which are present on both spire and base. The suture is very slightly impressed. The periphery is obsoletely angulated. The base is rather produced and moderately rounded. The aperture is auricular; the outer lip is broadly expanded and reflected, and the columella likewise is broadly expanded at its insertion and reflected over the base, leaving a narrow umbilical chink.

The type (U.S.N.M. 313672), collected by Quadras at Bulalacao, southeastern Mindoro, has 6.2 whorls and measures: Length, 45.8 mm; greater diameter, 22 mm; lesser diameter, 17.9 mm.

An additional series of specimens, some with localities and some without localities, but all from southeastern Mindoro, yields the following measurements:

U.S.N.M. no.	Number of whorls	Length	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
208128 [1]	7.0	45.9	20.6	17.7
208128 [1]	5.9	39.9	18.9	17.0
208122	6.2	41.0	19.5	17.4
208122	7.0	45.8	20.7	16.8
208122	6.1	41.6	20.6	17.1
208123	6.0	38.5	18.6	16.5
208123	6.0	38.5	19.4	17.6
208123	6.0	38.1	19.3	17.6
208123	6.8	44.5	21.0	18.6
208125	6.2	41.3	18.7	17.0
208125	6.0	37.8	19.1	16.9
208125	6.0	42.0	18.5	16.2
105041	6.0	37.0	18.5	16.7
105041	6.2	38.9	19.4	17.0
105041	6.0	37.4	19.1	17.0
105041	6.0	41.2	20.4	18.0
255905	6.3	39.0	18.4	16.4
255905	6.0	39.5	19.8	17.5
255905	6.5	43.7	19.4	17.0
255934	6.5	44.0	20.5	17.5
255934	6.2	40.7	19.8	17.5
20370	6.2	38.5	17.8	16.5
195419	6.0	37.7	18.8	17.0
195419	6.0	39.8	19.0	16.6
Average	6.2	40.5	19.4	17.1
Greatest	7.0	45.9	21.0	18.6
Least	5.9	37.0	17.8	16.2

[1] Topotype.

The medium size and yellow color will distinguish this race from all the others. In one or two of the specimens there is a slight tendency toward a red-brown hair line at the summit of the whorls.

COCHLOSTYLA (PROCHILUS) PARTULOIDES (Broderip)

PLATE 106

1841. *Bulinus partuloides* BRODERIP, Proc. Zool. Soc. London, 1840, p. 181.
1841. *Bulimus partuloides* PFEIFFER, Symbolae, vol. 3, p. 49.
1842. *Bulimus partuloides* REEVE, Conchologia systematica . . ., vol. 2, pl. 11, figs. 54a, 54b.
1853. *Bulimus partuloides* PFEIFFER, Monographia heliceorum viventium, vol. 3, p. 323.
1856. *Bulimus (Amphidromus) partuloides* PFEIFFER, Malakozool. Blätter, vol. 2, p. 147.
1859. *Bulimus partuloides* PFEIFFER, Monographia heliceorum viventium, vol. 4, p. 382.
1860. *Prochilus partuloides* MARTENS, Albers, Die Heliceen, ed. 2, p. 179.
1861. *Bulimus pan* PFEIFFER, Proc. Zool. Soc. London, 1861, p. 23, pl. 3, fig. 5; not *Helix pan* Broderip, 1841.
1861. *Bulimus pan* PFEIFFER, Novitates conchologicae, p. 163, pl. 44, figs. 6, 7.
1868. *Bulimus partuloides* PFEIFFER, Monographia heliceorum viventium, vol. 6, p. 28.
1877. *Bulimus partuloides* PFEIFFER, Monographia heliceorum viventium, vol. 8, p. 42.
1877. *Cochlostyla nigrocincta* SEMPER, Reisen im Archipel der Philippinen, pt. 2, vol. 3, p. 221.
1877. *Cochlostyla partuloides* SEMPER, *ibid.*, p. 221.
1892. *Cochlostyla partuloides* PILSBRY, Man. Conch., ser. 2, vol. 8, p. 50, pl. 16, figs. 20–24.
1895. *Helicostyla (Prochilus) partuloides* PILSBRY, Man. Conch., ser. 2, vol. 9, p. 231.
1896. *Prochilus partuloides* ELERA, Catalogo sistematico de toda la fauna de Filipinas, vol. 3, p. 611.
1897. *Cochlostyla partuloides* HIDALGO, Journ. Conchyl., vol. 44, pp. 258, 305, 309, 331, 332, 341, 350.
1898. *Cochlostyla partuloides* MÖLLENDORFF, Abh. Naturf. Ges. Görlitz, vol. 22, p. 145.
1901. *Cochlostyla partuloides* HIDALGO, Obras malacologicas, p. 57.
1914. *Cochlostyla (Prochilus) partuloides* MÖLLENDORFF, KOBELT, and WINTER, Semper's Reisen im Archipel der Philippinen, vol. 10, pp. 332–333, pl. 73, figs. 13, 14.
1932. *Cochlostyla (Prochilus) partuloides* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 338.

In this species, which also appears to be mutating, we have, as in *Cochlostyla (Prochilus) virgata* (Jay), a great variation in shape and coloration. Both of these features are shown on plate 106.

The shape of the shell varies from ovate to elongate-ovate. The shorter spire would be represented in what Pfeiffer called *pan*, and what Semper renamed *Cochlostyla nigrocincta*.

The nuclear whorls may be light or dark or any shade intermediate between them. There is here, as in *Cochlostyla (Prochilus) virgata*, a narrow white zone at the summit. The coloration of the shell when the periostracum is removed may be white or it may have a band at the summit, one at the periphery, and a dark area at the umbilicus, or there may be additional spiral zones of various shades of brown or some of those indicated may be absent. The interior of the aperture, even in the dark specimens, and the expanded lip and columella are bluish white. The periostracum as a rule is pale olivaceous-yellow. Nuclear whorls about 2.3, forming a moderately pointed apex, smooth except for incremental lines and on the last portion of the last turn indications of fine spiral striations. The postnuclear whorls are slightly rounded, appressed at the summit, and marked by retractively slanting lines of growth and closely approximated spiral striations, which are present on both spire and base. The suture is slightly impressed, and the periphery is somewhat inflated and shows an indication of an obsolete angle. The shortness causes this to appear inflated and strongly rounded. The aperture is broadly oval, the peristome being very broadly expanded and reflected. That of the inner lip is curled over to form a narrow umbilicus. The parietal wall is covered with a thin callus.

This species occupies eastern Mindoro from Calapan to Bulalacao. Its small partuloid shape will differentiate it from all the other *Prochilus*.

Sixty-one perfect specimens before me yield the following measurements:

U.S.N.M. no.	Number of whorls	Length	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
208124	5. 8	32. 2	16. 9	15. 2
208124	6. 2	36. 6	17. 5	15. 3
99844	5. 3	32. 2	17. 3	15. 5
99844	6. 0	32. 8	18. 1	15. 5
253704	6. 0	31. 6	17. 0	14. 3
253704	6. 0	33. 8	16. 5	15. 5
253704	6. 0	33. 6	16. 4	15. 2
20374	6. 4	39. 1	17. 6	16. 7
20372	6. 1	33. 6	16. 9	15. 9
20372	6. 1	34. 8	17. 5	15. 6
20372	6. 0	32. 8	17. 5	15. 4
20372	6. 1	34. 5	17. 4	16. 3
104367	5. 9	32. 6	16. 8	15. 5
104367	6. 2	35. 6	18. 2	15. 5
313673	6. 0	35. 2	17. 9	16. 7
313673	5. 9	34. 3	17. 3	15. 3
315859	5. 9	35. 3	18. 1	16. 3
104381	5. 9	35. 2	18. 4	16. 2
309421	6. 2	35. 7	19. 8	16. 1
130803	6. 1	37. 0	19. 9	17. 4
130803	5. 9	34. 6	17. 5	15. 9
313674	6. 1	35. 5	17. 7	16. 1
313674	6. 2	37. 4	18. 6	16. 4
313674	6. 1	37. 0	19. 3	17. 2
313674	5. 9	35. 9	18. 0	16. 1

U.S.N.M. no.	Number of whorls	Length	Greater diameter	Lesser diameter
		Mm	Mm	Mm
313674	6. 3	39. 9	18. 4	16. 3
313674	6. 3	37. 9	17. 9	16. 0
313674	6. 2	34. 2	17. 7	15. 6
313674	6. 2	36. 7	17. 7	16. 2
313674	5. 8	35. 3	19. 3	17. 5
313674	6. 0	36. 3	19. 3	17. 0
313674	6. 2	38. 0	17. 7	16. 0
313674	5. 9	36. 7	18. 9	16. 0
313675	6. 0	35. 4	17. 1	14. 6
313675	6. 0	35. 6	17. 6	15. 7
313675	6. 1	35. 2	18. 6	15. 7
313675	6. 0	35. 0	17. 8	15. 7
313675	5. 9	35. 7	17. 8	16. 5
313675	5. 9	34. 4	18. 3	15. 7
313675	6. 3	38. 3	19. 8	16. 7
309413	6. 2	39. 6	19. 4	16. 0
195419	6. 0	35. 7	16. 7	15. 4
195419	6. 1	35. 5	18. 4	16. 4
208120	6. 2	40. 4	18. 8	16. 2
208120	6. 1	37. 3	19. 0	16. 5
208120	6. 0	37. 8	17. 8	16. 7
208120	6. 1	37. 3	18. 9	16. 8
208120	6. 2	39. 8	19. 9	17. 8
208120	6. 0	34. 7	17. 7	16. 7
208120	6. 2	41. 8	19. 8	17. 5
208120	6. 1	35. 4	17. 8	16. 4
208120	6. 0	39. 5	18. 5	16. 8
208120	6. 2	43. 3	20. 6	18. 0
208120	6. 2	39. 8	18. 8	16. 7
208120	6. 2	39. 7	19. 8	17. 3
208120	6. 0	36. 0	18. 3	17. 0
208120	6. 0	36. 2	19. 4	16. 2
208120	6. 0	37. 2	19. 8	17. 6
208120	6. 0	34. 5	17. 5	15. 4
309438	6. 0	37. 9	18. 0	16. 2
309438	6. 1	38. 9	19. 1	16. 7
Average	6. 05	36. 26	18. 2	16. 2
Greatest	6. 4	43. 3	20. 6	18. 0
Least	5. 3	31. 6	16. 4	14. 3

COCHLOSTYLA (PROCHILUS) CUYOENSIS (Pfeiffer)

The shell of this species varies much in size in the different races. In all of them, however, it is slender, elongate-conic, and thin, never ponderous. There is a great variation in color. The thin periostracum varies from pale straw-color through orange-brown to deep chocolate-brown and may be plain or marked by hydrophanous fulgurations. A narrow dark-brown band may be present at the summit, and another, usually a much more conspicuous one, may be present at the periphery, and a third dark area about the umbilicus may mark the shells or all these bands may be absent. In some there is even an additional band between the umbilical dark area and the periphery. The intensity of coloration of this brown band varies in the different races as does the width thereof. All sorts of the elements mentioned are present in mutating groups. There are before me two shells from the Mindoro Province, both of which are smaller than any of the other subspecies belonging to this group. These two are here described.

There has been considerable confusion in what should constitute *Cochlostyla calobaptus* (Jonas), and the present species has by some been arranged as a subspecies of *calobaptus*. *Bulimus calobaptus* was originally described from Mindoro, and I am inclined to believe that it is one of the mutations of *Cochlostyla* (*Prochilus*) *virgata* (Jay); at least I seem to recognize in the figure published by Philippi in his Abbildungen und Beschreibungen, etc., volume 1, plate 1, *Bulimus* figure 6, a member of this complex. The next available specific name, therefore, for the group of shells that has been called *calobaptus* is *Cochlostyla* (*Prochilus*) *cuyoensis*, which I am here adopting. This species ranges over parts of Mindoro and the little islands about it and to the south of it and over the Busuanga group and southeastward to Tablas. In some places on some of the islands it seems to be perfectly stable, while on others it seems to be mutating. Here, as elsewhere, the mutations show a polyphyletic origin by having different colored nuclei, which would indicate hybridization.

KEY TO THE SUBSPECIES OF COCHLOSTYLA (PROCHILUS) CUYOENSIS IN MINDORO PROVINCE

Periphery with a dark-brown band.................................contracta
Periphery without a dark-brown band.............................subpallida

COCHLOSTYLA (PROCHILUS) CUYOENSIS CONTRACTA Möllendorff

Plate 107, Figure 5

1898. *Cochlostyla calobapta contracta* Möllendorff, Abh. Naturf. Ges. Görlitz, vol. 22, p. 144.

1914. *Cochlostyla calobapta contracta* Möllendorff, Kobelt, and Winter, Semper's Reisen im Archipel der Philippinen, vol. 10, p. 333, pl. 72, figs. 13–14.

1914. *Cochlostyla calobapta nana* Möllendorff, Kobelt, and Winter, *ibid.*, p. 333.

1932. *Cochlostyla* (*Prochilus*) *cuyoensis contracta* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 338.

Shell very small. The nuclear whorls have a broad band immediately anterior to the suture, but it disappears on the postnuclear turns. There is also a broad conspicuous bright chestnut-brown band at the periphery and a broad area of the same color about the umbilicus. The periostracum is pale straw-color and marked by protractively slanting, more or less zigzag, broad hydrophanous bands. Interior of aperture, peristome, and columella white. Nuclear whorls 2, strongly rounded and forming a rather pointed apex. They are marked by incremental lines, which are somewhat crinkled at the summit. The postnuclear whorls are moderately rounded, appressed at the summit, and marked by retractively curved lines of growth, which are almost threadlike and extend equally strong over spire and base. Aperture broadly oval; outer lip partly expanded and reflected; inner lip quite broad, reflected to form a narrow umbilicus.

The specimen described and figured (U.S.N.M. no. 313670) was collected by Quadras on Mindoro without definite locality. It has 5.3 whorls and measures: Length, 25.2 mm; greater diameter, 14.4 mm; lesser diameter, 12.9 mm.

This race is a miniature of the larger subspecies found on Tablas Island.

COCHLOSTYLA (PROCHILUS) CUYOENSIS SUBPALLIDA Bartsch

Plate 107, Figure 8

1932. *Cochlostyla* (*Prochilus*) *cuyoensis subpallida* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 338.

Shell very small and thin, semitranslucent, of pale straw-color, marked by broad, retractively slanting, hydrophanous bands, which appear to terminate at the periphery. There is the faintest indication of a peripheral dark band and an ill-defined columellar area of the same shade. The nuclear whorls are white. The interior of the aperture, peristome, and columella are likewise white. Nuclear whorls 1.5, well rounded, smooth except for incremental lines, which render the summit slightly crenulated. The postnuclear whorls are moderately rounded, appressed at the summit, and marked by retractively slanting lines of growth, which are faintly threadlike. Suture moderately constricted. Periphery with the merest indication of an obsolete angle. Base moderately long, well rounded; aperture broadly oval; outer lip expanded and reflected; inner lip broadly expanded and reflected to form the narrow umbilicus. The parietal wall is covered by a straw-colored callus.

The type (U.S.N.M. no. 313671) was collected by C. Canonizado on Caluya Island. It has 5.3 whorls and measures: Length, 25.1 mm; greater diameter, 14.1 mm; lesser diameter, 12.5 mm.

This race differs from *Cochlostyla* (*Prochilus*) *cuyoensis contracta* in its exceedingly thin shell, which permits all the interior to be seen by transmitted light, and in lacking the decided color bands.

COCHLOSTYLA (PROCHILUS) FICTILIS (Broderip)

Shell small, spindle-shaped, covered with a thick periostracum, which is usually fulgurated with hydrophanous bands. In one of the subspecies, *Cochlostyla* (*Prochilus*) *fictilis mangarina*, there is a broad white band at the summit; in the others this is absent. The ground color varies considerably, but usually it is some shade of brown. The interior of the aperture is bluish white, and the peristome is of the same shade or tinged with pale yellow. Typical *Cochlostyla*

(*Prochilus*) *fictilis fictilis* (Broderip) and *Cochlostyla* (*Prochilus*) *fictilis larvata* (Broderip) come from Cuyo Island, which is one of the elements of the northern Calamian group.

The three subspecies that I am here describing come from the southwestern tip of Mindoro, southeastern part of Mindoro, and the Island of Ambulong immediately southwest of Ilin Island, also adjacent to Mindoro.

KEY TO THE SUBSPECIES OF COCHLOSTYLA (PROCHILUS) FICTILIS IN MINDORO PROVINCE

Shell yellow ---------- **fulva**
Shell not yellow.
    Shell brownish.
        White band at summit very narrow ---------- **ambulonensis**
        White band at summit very broad ---------- **cagurana**

COCHLOSTYLA (PROCHILUS) FICTILIS FULVA Bartsch

Plate 107, Figures 6–7

1914. *Cochlostyla* (*Prochilus*) *larvata* Möllendorff, Kobelt, and Winter, Semper's Reisen im Archipel der Philippinen, vol. 10, p. 332 (in part), pl. 73, figs. 11, 12.

1932. *Cochlostyla* (*Prochilus*) *fictilis fulva* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 339.

Von Möllendorff, Kobelt, and Winter described and figured, under the name *Cochlostyla* (*Prochilus*) *larvata*, a shell in the following terms: "Shell small, subperforate, subfusiform, pyramidal, quite solid, shining, nearly smooth, yellowish, subunicolor, or ornamented with pale oblique distant streaks. Spire pyramidal, turreted; apex somewhat obtuse. Whorls 6, nearly flattened, slightly increasing. Suture slightly impressed, the last whorl equaling two-fifths of the entire length of the shell, slightly descending anteriorly. Base attenuated. Aperture narrow, oblong, oval, compressed at the base, white within. Peristome thickened, white, with partly expanded margin. Parietal callus very thin, translucent but well defined externally; it does not render the peristome complete. The external margin of the peristome is broadly expanded, thickened, white, joining the columella with the posterior angle of the aperture." The measurements given by these authors are: Altitude 32.5 mm; diameter, 19 mm. Altitude of aperture with peristome, 14 mm; diameter, 10 mm.

They cited southeast Mindoro as the type locality and stated that the specimen figured is considerably smaller than the typical race, that it appears to be almost unicolor, except for a very small remnant of the basal columellar dark area, but that it has the characteristic, almost spindle, shape of the type.

I have not seen specimens of it and have given a free translation of the Latin diagnosis and a copy of their figure.

COCHLOSTYLA (PROCHILUS) FICTILIS AMBULONENSIS Bartsch

PLATE 107, FIGURE 3

1901. *Cochlostyla fictilis* ELERA, Catalogo sistematico de toda la fauna de Filipinas, vol. 3, p. 609; in part.

1914. *Cochlostyla fictilis* MÖLLENDORFF, KOBELT, and WINTER, Semper's Reisen im Archipel der Philippinen, vol. 10, pp. 334–335 (in part), pl. 73, figs. 15, 16.

1932. *Cochlostyla* (*Prochilus*) *fictilis ambulonensis* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 339.

Shell small, spindle-shaped, covered with a thin periostracum, which varies apparently in its color scheme, being in the hydrophanous areas pale straw-yellow. In the darker area it is either transparent or partakes of the dark portion of the subadjacent shell. Interior of aperture, the expanded outer lip, columella, and parietal callus white. Nuclear whorls 1.7, forming a slender apex, marked only by lines of growth. Postnuclear whorls rather high between the summit and suture, appressed at the summit, slightly rounded, and marked by retractively slanting lines of growth and rather strong and rather distantly spaced incised spiral lines, which are present on both spire and base. Suture moderately constricted. Periphery well rounded. Base produced, moderately rounded. Aperture very elongate-ovate. Outer lip broadly expanded, particularly basally, and reflected. The inner lip broadly expanded and reflected, forming the narrow umbilicus. Parietal wall covered by a thick callus, which, while translucent, nevertheless shows whitish.

The type (U.S.N.M. no. 313600), collected by Quadras on Ambulon Island, has 6.1 whorls and measures: Length, 36.7 mm; greater diameter, 14.9 mm.

U.S.N.M. no. 313601, from the same source, has 6.5 whorls and measures: Length, 39.7 mm; greater diameter, 16.4 mm.

Still another (U.S.N.M. no. 104349), from the Cuming collection, without definite locality, has 5.5 whorls and measures: Length, 38.8 mm; greater diameter, 16.2 mm.

COCHLOSTYLA (PROCHILUS) FICTILIS CAGURANA Bartsch

PLATE 107, FIGURE 2

1932. *Cochlostyla* (*Prochilus*) *fictilis cagurana* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 339.

Shell spindle-shaped. The early whorls white, gradually passing through pale buff and darker buff into brown, the last whorl being dark chestnut-brown except for a broad zone of white near the summit. The peristome, columella, and interior of aperture are white. In addition to this the shell is marked by broad axial zones of white. Nuclear whorls 2, rather high, forming a rather pointed apex. Postnuclear whorls high between the summit and suture, appressed at the summit, slightly rounded, marked by retractively curved axial lines of growth and wavy, moderately deeply incised, rather distantly spaced spiral lines. Suture very slightly constricted; periphery strongly rounded. Base protracted, moderately rounded. Aperture broadly oval; outer lip very broadly expanded and reflected, thick. The inner lip also broadly expanded and very thick and reflected over the umbilical area, leaving only a narrow chink anteriorly. The parietal wall is covered by a thick whitish callus.

The type (U.S.N.M. no. 313598), collected by Pedro de Mesa at Mangarin or Cagurai, in southwestern Mindoro, has 6.4 whorls and measures: Length, 38.3 mm; greater diameter, 15.9 mm.

Three additional specimens (U.S.N.M. no. 313599), considerably smaller than the type, yield the following measurements:

Number of whorls	Length	Greater diameter	Lesser diameter
	Mm	*Mm*	*Mm*
6.0	31. 4	14. 6	------
5.6	30. 0	14. 7	------
6.2	32. 0	13. 8	------

This race is easily distinguished from the other Mindoro shells by its broad white band at the summit.

Subgenus CHRYSALLIS Albers

In this subgenus the shell varies from ovate to ovate-conic to pupiform. Its base is slightly perforated. There is a great diversity in the thickness of the shell in the various species and races. The color varies from white through yellow, tawny to brown, and almost blackish brown, and the hydrophanous periostracum is equally variable, usually forming axial streaks or fulgurations of varying width and extent. The aperture may be white or dark within. The peristome varies also from white through buff through brown to iridescent bluish black.

The type is *Cochlostyla chrysalidiformis* (Sowerby).

COCHLOSTYLA (CHRYSALLIS) CHRYSALIDIFORMIS (Sowerby)

Shell elongate-conic to pupiform, ranging in color from almost white through pale straw-color to lemon-yellow. Some races are unicolor, that is, almost white throughout, but even these show near the summit a series of hydrophanous marks corresponding more or less to hydrophanous axial bands. In shells that have a brown spiral zone immediately below the summit, the hydrophanous bands when present in the periostracum cause this brown band to be broken up into spots. The peristome may be white, yellowish, or brownish purple. Usually the shells with the brown subsutural band have the dark-colored peristome. In the forms with the dark peristome the outer edge of the parietal callus is also tinted with the same shade. The postnuclear whorls are marked by irregular and irregularly developed, somewhat retractively slanting, rather closely spaced, obsolete riblets, which vary considerably in strength in the races here described. This species is confined to the island of Mindoro.

I am resurrecting *Cochlostyla ustulata* (Jay), as I have, in all the material that I have seen, not found any intergrade between this and *Cochlostyla chrysalidiformis.* Furthermore, the island of Mindoro has so many races of other things geographically separated that I feel certain that the forms of *Cochlostyla chrysalidiformis*, which I am here recognizing, will be found to have a geographic basis.

KEY TO THE SUBSPECIES OF COCHLOSTYLA (CHRYSALLIS) CHRYSALIDIFORMIS

Summit of the whorls with a brown band.
  Shell elongate-ovate------------------------------------chrysalidiformis
  Shell cylindric--macra
Summit of the whorls without a brown band.
  Exterior of shell rough--villosa
  Exterior of shell not rough.
    Parietal wall straw-color.
      Shell thin, diaphanous------------------------------------rarior
      Shell not thin or diaphanous-----------------------------enodosa
    Parietal wall brown---fuscata

COCHLOSTYLA (CHRYSALLIS) CHRYSALIDIFORMIS CHRYSALIDIFORMIS (Sowerby)

Plate 108, Figure 5

1833. *Bulinus chrysalidiformis* Sowerby, Proc. Zool. Soc. London, 1833, p. 37.
1833. *Bulinus chrysalidiformis* Sowerby, The conchological illustrations, pl. 30, fig. 28.
1836. *Bulinus chrysalidiformis* Müller, Synopsis . . . testaceorum viventium . . . , p. 26.
1838. *Bulimus chrysalidiformis* Deshayes, Lamarck's Histoire naturelle des animaux sans vertèbres, ed. 2, vol. 8, p. 278.
1841. *Bulinus chrysalidiformis* Broderip, Proc. Zool. Soc. London, 1840, p. 86; in part.
1848. *Bulimus chrysalidiformis* Pfeiffer, Monographia heliceorum viventium, vol. 2, p. 76.
1848. *Bulimus chrysalidiformis* Reeve, Conchologia iconica, pl. 4, fig. 16.
1850. *Bulimus* (*Chrysallis*) *chrysalidiformis* Albers, Die Heliceen, ed. 1, p. 141.
1851. *Bulimus chrysalidiformis* Deshayes, Férussac's Histoire naturelle . . . mollusques . . . , vol. 2, pp. 56–57 (in part), pl. 149, figs. 10–11.
1855. *Bulimus chrysalidiformis* Pfeiffer. Martini-Chemnitz Conchylien Cabinet, ed. 2, vol. 1, Abt. 13, Theil 1, pp. 201–202, pl. 57, fig. 3.
1855. *Cochlostyla* (*Chrysallis*) *chrysalidiformis* H. and A. Adams, The genera of recent Mollusca, vol. 2, p. 143.
1856. *Bulimus chrysalidiformis* Pfeiffer, Malakozool. Blätter, vol. 2, p. 150.

1860. *Chrysallis chrysalidiformis* Martens, Albers, Die Heliceen, ed. 2, p. 179.
1892. *Cochlostyla chrysalidiformis* Pilsbry, Man. Conch., ser. 2, vol. 8, p. 51, pl. 14, fig. 64.
1895. *Helicostyla chrysalidiformis* Pilsbry, Man. Conch., ser. 2, vol. 9, p. 231.
1897. *Cochlostyla chrysalidiformis* Hidalgo, Journ. Conchyl., vol. 44, pp. 247, 263, 271, 322, 331, 340, 350.
1898. *Cochlostyla chrysalidiformis* Möllendorff, Abh. Naturf. Ges. Görlitz, vol. 22,p. 146.
1901. *Cochlostyla chrysalidiformis* Hidalgo, Obras malacologicas, pp. 550–551 (in part), pl. 105, fig. 3; pl. 155, fig. 9.
1914. *Cochlostyla* (*Chrysallis*) *chrysalidiformis* Möllendorff, Kobelt, and Winter, Semper's Reisen im Archipel der Philippinen, vol. 10, pp. 335–336, pl. 75, figs. 1, 2.
1932. *Cochlostyla* (*Chrysallis*) *chrysalidiformis chrysalidiformis* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 339.
1933. *Helicostyla* (*Chrysallis*) *chrysalidiformis* Clench and Archer, Papers Michigan Acad. Sci., Arts, Letters, vol. 17, p. 552.

Shell elongate-ovate, with a thin, translucent, yellowish periostracum, which is marked by axial hydrophanous streaks that extend up to the summit of the whorls across the brown bands, where they give to the shell an almost denticulated appearance. When the periostracum is removed the shell is soiled flesh-color, and has a moderately broad brown zone immediately below the summit and this zone extends up to the nuclear whorls to the very beginning of the shell, becoming increasingly narrower. The peristome is fringed by a pale purplish chocolate zone, which also marks more or less distinctly the outer edge of the parietal callus. The interior of the aperture is bluish white. Nuclear whorls 2.5, smooth, except a little frilling at the summit; the postnuclear markings, particularly the hydrophanous zones, carry over at least half of the nucleus. The postnuclear whorls are moderately rounded, almost appressed at the summit, and marked by low, rather broad, closely spaced, irregular, slightly retractively curved, axial riblets, which give to the surface of the shell a rather rough appearance. These riblets, or exaggerated growth lines, extend over the base to the umbilical region. The periphery of the last whorl shows as a decidedly obsolete angle. Aperture oval. Outer lip rather strongly reflected, thin; the inner lip with a decided twist, almost amounting to a tooth, expanding basally into a broad callus, which is reflected over the base and extends over the parietal wall as a thin callus.

The specimen described and figured (U.S.N.M. no. 14354) is one received from Cuming. It has 7.5 whorls and measures: Length, 69 mm; greater diameter, 30 mm. Another, bearing the same catalog number, has 6.9 whorls and measures: Length, 62.7 mm; greater diameter, 32 mm.

In addition we have seven specimens and a young example, none of which bears a specific locality: Two from the Jay collection (U.S.N.M.

no. 104355) have 7.1 and 6.9 whorls and measure: Length, 71.6 and 60 mm; greater diameter, 31.5 and 39.2 mm, respectively. Two (U.S.N.M. no. 104050) collected by Rich (who was on the U. S. Exploring Expedition, but the expedition touched only at the southern end of the island) have 7.5 and 7.2 whorls and measure: Length, 66.1 and 63.3 mm; greater diameter, 29.7 and 27.2 mm, respectively. Two and a young specimen (U.S.N.M. no. 20348) collected by the Exploring Expedition, probably also were purchased in Manila. One of these has 7.5 whorls and measures: Length, 74.8 mm; greater diameter, 33 mm. The other adult specimen has an injured tip and so was not measured. U.S.N.M. no. 109467, from the Redfield collection, has 7.1 whorls and measures: Length, 66 mm; greater diameter, 31.7 mm.

Sowerby, in describing this species, stated that it came from Central America. The Cuming specimens probably all came from northeastern Mindoro.

COCHLOSTYLA (CHRYSALLIS) CHRYSALIDIFORMIS MACRA Bartsch

Plate 108, Figure 6

1932. *Cochlostyla* (*Chrysallis*) *chrysalidiformis macra* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 339.

Shell very slender, pupiform, covered with a pale straw-colored periostracum, which is crossed by axial, somewhat zigzag, retractively curved, hydrophanous zones that extend upon the dark band at the summit as false teeth. The early whorls are darker in color than the last two-thirds of the shell. When the periostracum is removed a brown zone is apparent immediately below the summit on all the turns. The outer edge of the reflected peristome is of a bright reddish-brown tone, and so is the outer edge of the columella and parietal callus. The interior of the aperture is white. Nuclear whorls about 2.5, smooth. The postnuclear whorls are moderately rounded, marked by strong, somewhat rough, retractively slanting lines of growth, which almost attain the strength of riblets and which extend over the base to the umbilical area. The sculpture is a little weaker than in the typical race. The summit of the whorls is appressed, and the suture is but slightly constricted. The periphery is well rounded. The aperture is irregularly auriculate. The peristome is expanded and reflected, that of the inner lip being broadly expanded at the insertion of the inner lip and reflected over the umbilicus, leaving only a narrow chink. It extends over the parietal wall as a thin callus.

The type (U.S.N.M. no. 382969) is without specific locality. It has 8 whorls and measures: Length, 74 mm; greater diameter, 24.7 mm.

The extreme slenderness of this race distinguishes it from the other forms.

COCHLOSTYLA (CHRYSALLIS) CHRYSALIDIFORMIS VILLOSA Bartsch

Plate 108, Figure 2

1841. *Bulinus chrysalidiformis* var. *d* Broderip, Proc. Zool. Soc. London, 1840, p. 86.
1892. *Cochlostyla chrysalidiformis* Pilsbry, Man. Conch., ser. 2, vol. 8, p. 52 (in part), pl. 14, fig. 65.
1901. *Cochlostyla chrysalidiformis* var. *D* Hidalgo, Obras malacologicas, p. 551, pl. 105, fig. 4.
1932. *Cochlostyla* (*Chrysallis*) *chrysalidiformis villosa* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 339.

Shell elongate-ovate. The early whorls are white, the later whorls covered with a pale straw-colored periostracum, which is crossed at more or less regular intervals by axial hydrophanous bands. The base is colored like the preceding portion of the last turn. Aperture and peristome white. Nuclear whorls 2.2, well rounded, smooth except for a few lines of growth. The postnuclear whorls are moderately rounded, appressed at the summit, and marked by rather rough, somewhat wrinkled, flattened, axial riblets, which are of irregular strength and spacing and extend to the umbilical chink. Suture slightly constricted. The periphery is feebly obsoletely angulated. Aperture auricular; the outer lip broadly expanded and reflected; the inner lip also broadly expanded at its insertion and reflected over the umbilicus, extending as a thin callus over the parietal wall.

The type (U.S.N.M. no. 315858) comes from the Evezard collection and is labeled merely "Philippines." It probably belongs in northeastern Mindoro. It has 7.1 whorls and measures: Length, 66.8 mm; greater diameter, 31.2 mm.

This shell in general shape and sculpture resembles most nearly typical *Cochlostyla chrysalidiformis chrysalidiformis*, being a little rougher in sculpture and lacking the dark colored band at the summit and the dark edge to the lip. It can be distinguished from *Cochlostyla chrysalidiformis enodosa* by its larger size, more elongate form, and stronger sculpture.

COCHLOSTYLA (CHRYSALLIS) CHRYSALIDIFORMIS RARIOR Bartsch

Plate 108, Figure 4

1932. *Cochlostyla* (*Chrysallis*) *chrysalidiformis rarior* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 339.

The shell is very thin, diaphanous, elongate-conic, pupiform. The early whorls and the interior of the aperture and peristome are milk white. The postnuclear whorls are covered with a thin, translucent, yellowish periostracum, which is marked by pale buff, retractively slanting, fulgurations. Nuclear whorls 3, forming a moderately elevated apex, marked by retractively slanting lines of growth, which are strongest on the last turn where they render the summit slightly crinkled. The last whorl is also marked by closely spaced, incised, spiral striations. The postnuclear whorls are appressed at the summit, moderately rounded, marked by retractively slanting lines of growth and closely spaced, microscopic, spiral striations and still finer criss-cross sculpture, which cuts the lines of growth obliquely and is present on both spire and base. Suture slightly constricted. The periphery is feebly obsoletely angulated. The base is rather long, well rounded. Aperture oval. The peristome is strongly expanded and reflected; columella broadly expanded at its insertion and reflected to form the umbilical chink. The parietal wall is covered by a rather thick callus.

The type (U.S.N.M. no. 313644), collected by Pedro de Mesa at Calawagan, Paluan, Mindoro, has 7.1 whorls and measures: Length, 63.8 mm; greater diameter, 29 mm; lesser diameter, 24 mm.

U.S.N.M. no. 313645 contains eight topotypes received from the same source, seven of which yield the following measurements:

Number of whorls	Length	Greater diameter	Lesser diameter
	Mm	*Mm*	*Mm*
7. 0	56. 4	28. 1	23. 8
6. 4	51. 5	26. 4	22. 1
7. 0	58. 5	27. 9	29. 0
6. 3	49. 1	25. 9	22. 3
6. 1	42. 4	23. 7	20. 3
6. 5	60. 7	30. 3	24. 9
6. 5	59. 5	26. 5	23. 4
6. 54 [1]	[1] 54. 0	[1] 26. 97	[1] 23. 68
7. 0 [2]	[2] 60. 7	[2] 30. 3	[2] 29. 0
6. 1 [3]	[3] 42. 4	[3] 23. 7	[3] 20. 3

[1] Average. [2] Greatest. [3] Least.

This race is remarkable for the extreme thinness of its shell and for the enormous variation in size in the different specimens, as brought out by the table of measurements.

COCHLOSTYLA (CHRYSALLIS) CHRYSALIDIFORMIS ENODOSA Bartsch

PLATE 108, FIGURE 3

1932. *Cochlostyla* (*Chrysallis*) *chrysalidiformis enodosa* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 339.

Shell ovate, apparently in perfect specimens covered by a golden-yellow periostracum; at least this is indicated by a few shreds that are left on our shells and also by the part covered by the parietal callus. The only specimen before me is badly denuded. The peristome and aperture are white. The nuclear whorls are well rounded, smooth. The postnuclear whorls are moderately rounded and appressed at the summit, separated by a slightly constricted suture.

Periphery of the last whorl well rounded. Aperture oval. Outer lip moderately expanded and reflected; inner lip broadly expanded at its insertion and reflected over the umbilicus, extending over the parietal wall as a rather heavy callus.

The type (U.S.N.M. no. 382970) was collected by the Exploring Expedition, probably in the southern tip of the island of Mindoro where the expedition made a landing. It has 6.9 whorls and measures: Length, 59.8 mm; greater diameter, 28.9 mm.

This form is nearest related to *Cochlostyla chrysalidiformis villosa*, from which it can easily be distinguished by its more ovate form and much less strongly developed sculpture.

COCHLOSTYLA (CHRYSALLIS) CHRYSALIDIFORMIS FUSCATA Bartsch

Plate 108, Figure 1

1932. *Cochlostyla* (*Chrysallis*) *chrysalidiformis fuscata* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 340.

Shell elongate-ovate, with a rather regularly conic spire. The early whorls are flesh-color, the succeeding turns gradually becoming more yellow and tending to orange on the last volution. The parietal wall is covered by a pale-brown callus. Peristome soiled white. The interior of aperture is white with a grayish tinge. In addition there are hydrophanous bands extending from the summit, which they render falsely denticulate, to the umbilical chink. Nuclear whorls 2.2, well rounded, smooth. The postnuclear whorls are only slightly rounded; the last one is very feebly obsoletely angulated at the periphery, with the base well rounded. The whorls are appressed at the summit and marked by rather weak, irregularly developed, retractively slanting, closely spaced lines of growth, which extend to the umbilical chink at the last turn. Suture but slightly constricted. Aperture rather broadly oval. The outer lip is slightly expanded and reflected; the inner lip is rather broadly expanded and reflected over the base as a thick callus. The parietal wall is covered by a thin translucent callus, which permits the brown parietal wall to shine through.

The type (U.S.N.M. no. 382971) was collected by Lieutenant Febiger. It has 6.8 whorls and measures: Length, 70.7 mm; greater diameter, 32.4 mm.

No specific locality is given, but the specimens are labeled *Cochlostyla mindoroensis* and are from the Lea collection, which would indicate that they came from Mindoro.

Two additional specimens (U.S.N.M. no. 104356), from the same source, have 6.2 and 7 whorls and measure: Length, 58.7 and 60.1 mm; greater diameter, 28.9 and 34 mm, respectively.

COCHLOSTYLA (CHRYSALLIS) JAYI Bartsch

1932. *Cochlostyla* (*Chrysallis*) *jayi* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 340.

Shell pupiform, almost cylindro-conic, rather heavy. The apex varies in color from white to dark chestnut-brown. The early postnuclear whorls are considerably lighter than the later turns. The postnuclear whorls are covered by a moderately thick periostracum, which may be axially banded, streaked, blotched, spotted, or fulgurated with yellowish buff. These markings extend to the umbilical chink on the last whorl. The aperture is bluish white or pinkish white, while the expanded and reflected peristome may be soiled white, brownish, or almost black with an iridescent blue reflection. Nuclear whorls usually 3, well rounded; the first one is smooth, those succeeding are marked by fine incremental lines. The postnuclear whorls are appressed at the summit, moderately well rounded, and marked by irregular, low, closely approximated, threadlike lines of growth and also by obsolete indications of spiral striations and fine crisscross microscopic lines that cut the lines of growth obliquely. The base is sculptured like the spire. The aperture is oval, oblique, almost auricular, with the peristome decidedly expanded and reflected. That of the inner lip broadly expanded at the insertion of the columella where it is reflected over the base to almost cover the umbilicus. The parietal wall is covered by a moderately thick callus. The number of whorls varies between 7 and 8. The detailed measurements are given under the races here recognized.

Of this species I am now recognizing three subspecies, two of which are bright chestnut-brown in the dark coloration, while the third is much darker. The two paler-colored subspecies have brown lips, while the dark one has an almost black lip with a purplish tinge. The first of these, typical *Cochlostyla* (*Chrysallis*) *jayi jayi*, comes from northeastern Mindoro; the second, corresponding with this in color, comes from Calawagan near Paluan in northwestern Mindoro; while the dark-colored race occupies an intermediate position on the north coast centering about Abra de Ilog.

KEY TO THE SUBSPECIES OF COCHLOSTYLA (CHRYSALLIS) JAYI

The ground color of the last whorl bright chestnut-brown.
Shell large, length more than 70 mm ---------------------------------- **jayi**
Shell not large, length less than 65 mm -------------------------- **perpusilla**
The ground color of the last whorl almost blackish brown -------- **camorongana**

COCHLOSTYLA (CHRYSALLIS) JAYI JAYI Bartsch

Plate 109, Figure 6

1839. *Bulimus ustulatus* Jay, Catalogue of recent shells in the cabinet of John C. Jay, ed. 2, p. 119, pl. 6, fig. 1.

1841. *Bulinus chrysalidiformis* var. *a* and *b* Broderip, Proc. Zool. Soc. London, 1840, p. 86.
1848. *Bulimus chrysalidiformis* Reeve, Conchologia iconica, pl. 4, fig. 16b; in part.
1851. *Bulimus chrysalidiformis* Deshayes, Férussac's Histoire naturelle . . . mollusques . . ., vol. 2, pp. 56–57 (in part), pl. 149, figs. 5, 6.
1855. *Bulimus chrysalidiformis* Pfeiffer, Martini-Chemnitz Conchylien Cabinet, ed. 2, vol. 1, Abt. 13, Theil 1, pp. 201–202 (in part), pl. 57, figs. 1, 2.
1859. *Chrysallis chrysalidiformis* Chenu, Man. Conch., vol. 1, p. 434, fig. 3194.
1891. *Cochlostyla chrysalidiformis* Hidalgo, Obras malacologicas, pp. 550–551. pl. 155, fig. 3; in part.
1892. *Cochlostyla chrysalidiformis* Pilsbry, Man. Conch., ser. 2, vol. 8, pp. 51–52 (in part), pl. 14, figs. 66, 67.
1892. *Cochlostyla chrysalidiformis ustulatus* Pilsbry, *ibid.*, pp. 51–52, pl. 14, figs. 66, 67.
1895. *Helicostyla chrysalidiformis ustulatus* Pilsbry, Man. Conch., ser. 2, vol. 9, p. 231.
1896. *Chrysallis chrysalidiformis* var. *ustulata* Elera, Catalogo sistematico de toda la fauna de Filipinas, vol. 3, p. 611.
1897. *Cochlostyla ustulata* Hidalgo, Journ. Conchyl., vol. 44, pp. 247, 322.
1898. *Cochlostyla chrysalidiformis ustulatus* Möllendorff, Abh. Naturf. Ges. Görlitz, vol. 22, p. 146.
1898. *Cochlostyla ustulata* Möllendorff, *ibid.*, p. 146.
1901. *Cochlostyla chrysalidiformis* var. *c* Hidalgo, Obras malacologicas, pt. 1, pp. 550–551 (in part), pl. 105, fig. 3.
1914. *Cochlostyla chrysalidiformis ustulatus* Möllendorff, Kobelt, and Winter, Semper's Reisen im Archipel der Philippinen, vol. 10, p. 336, pl. 75. fig. 3.
1932. *Cochlostyla* (*Chrysallis*) *jayi jayi* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 340.

Through an evident oversight, Jay gave to this shell the name *Bulimus ustulatus* on page 119 of his Catalogue, forgetting *Bulimus ustulatus* Sowerby published in 1833 in Conchological Illustrations, figure 42, which Jay quotes on page 57 of his Catalogue, where he describes his shell as "1919b *Bulimus ustulatus* Sowb., Conch. Illust., fig. 42." The fact that most authors consider Jay's name a synonym of *Cochlostyla chrysalidiformis* (Sowerby) has been responsible for its not having been rechristened. I therefore have renamed it *Cochlostyla* (*Chrysallis*) *jayi*.

Shell large, pupiform, cylindro-conic, rather rough. The early whorls are flesh-color with a narrow brownish zone at the summit. This gradually changes through straw-color to bright chestnut-brown ground color and is crossed by hydrophanous axial zigzag bands of straw-color. This coloration also holds good on the base. The aperture is bluish white within, and the peristome and columella are livid with a purplish tinge. The parietal callus is thin and of the same color as the peristome. Nuclear whorls 2.8, well rounded, smooth. The postnuclear whorls are slightly rounded, appressed at the summit, and marked by retractively curved irregular lines of growth, which give to the surface a somewhat rough appearance, almost that of being marked by closely spaced, flattened, threadlike riblets. The entire surface of the shell is marked by numerous fine, oblique, crisscross lines, which run obliquely across the lines of growth, both protractively and retractively. Both of these elements are of about the same strength and give to the surface a somewhat netted appearance when viewed under the microscope. The aperture is somewhat irregularly ovate, not infrequently oblique; the peristome is broadly expanded and reflected on the outer and basal lips. The inner lip is also broadly expanded, particularly so at the insertion of the columella, where it is reflected and adnate to the base but leaves behind its edge the umbilical chink. The parietal wall is glazed by a moderately thick callus.

The specimen described and figured (U.S.N.M. no. 104352) was collected by Cuming and therefore comes from the northeastern region of the island. It has 7.2 whorls and measures: Length, 70.6 mm; greater diameter, 31.2 mm.

Another specimen (U.S.N.M. no. 104353), also of Cuming's collecting, likewise has 7.2 whorls and measures: Length, 70.8 mm; greater diameter, 31.2 mm. There are eight additional specimens before me without specific localities.

Two specimens (U.S.N.M. no. 20350a) were obtained by the U. S. Exploring Expedition. These show considerable differences from those just described for the northern race. It is more than likely that they were obtained in the southern tip of Mindoro where the Exploring Expedition collected. However, they are too decorticated to serve as the basis for a description. The defining of the southern race will, therefore, have to await the arrival of more material.

COCHLOSTYLA (CHRYSALLIS) JAYI PERPUSILLA Bartsch

Plate 109, Figure 8

1932. *Cochlostyla* (*Chrysallis*) *jayi perpusilla* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 340.

The shell is cylindro-conic. Nuclear whorls buff. The early postnuclear whorls are very pale chestnut-brown; the last one is dark chestnut-brown fulgurated with almost vertical broad hydrophanous bands. The interior of the aperture and peristome are smoky bluish white, the latter being edged with brown. The columella has the same color scheme as the outer lip. The rest of the features are as in typical *Cochlostyla* (*Chrysallis*) *jayi jayi*, except that the aperture in the specimen before me seems more regular.

The type (U.S.N.M. no. 313685) was collected by Mr. de Mesa at Calawagan near Paluan, Mindoro. It has 7 whorls and measures: Length, 64.7 mm; greater diameter, 28.6 mm; lesser diameter, 24.7 mm.

Although I have only the type of this race before me, I believe that it is a perfectly well-recognized subspecies, differing from typical *Cochlostyla* (*Chrysallis*) *jayi jayi* in its much smaller size and its wide zoogeographical separation from the typical form, and that subsequent material will substantiate my contention.

COCHLOSTYLA (CHRYSALLIS) JAYI CAMORONGANA Bartsch

PLATE 109, FIGURE 7

1932. *Cochlostyla* (*Chrysallis*) *jayi camorongana* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 340.

1933. *Helicostyla* (*Chrysallis*) *ustulata* CLENCH and ARCHER, Papers Michigan Acad. Sci., Arts, Letters, vol. 17, p. 551, pl. 58, fig. 6.

Shell pupoid, almost cylindro-conic. The nuclear whorls are of bluish color or dark chocolate-brown. The early postnuclear whorls are chestnut-brown, while the last turn is of almost blackish-brown ground color. The periostracum covering the postnuclear whorls is variegated with axial streaks, spots, dashes, or fulgurations of yellowish buff. The aperture is bluish white, and the broadly expanded and reflected peristome is almost black with a very bright iridescent bluish reflection. The triangle of the inner edge of the columella near its insertion is bluish smoky, while the parietal wall is covered with a transparent callus. Nuclear whorls 3, well rounded; the first smooth, the next showing incremental lines, while the last shows the sculpture of the postnuclear whorls. The postnuclear whorls are appressed at the summit and marked by low, rounded, closely approximated, somewhat irregularly developed lines of growth and numerous pale ill-defined spiral striations. In addition the usual fine microscopic crisscross sculpture that cuts the lines of growth obliquely, both protractively and retractively, is present. The sculpture of the spire is also characteristic of the base. The aperture is oblique, subauricular; the inner lip is reflected over the umbilicus at its insertion.

The type (U.S.N.M. no. 313620) was collected by Pedro de Mesa at Camorong, Municipality of Abra de Ilog, northern Mindoro. It has 7.4 whorls and measures: Length, 73 mm; greater diameter, 28.8 mm; lesser diameter, 25.8 mm.

A series of topotypes, all collected by Mr. de Mesa, yields the measurements shown on the following page.

U.S.N.M. no.	Number of whorls	Length	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
313621	7. 5	76. 8	30. 3	28. 8
313621	7. 1	68. 3	30. 3	26. 0
313621	6. 7	64. 5	25. 7	24. 4
313621	6. 9	64. 5	28. 7	25. 8
313652	6. 6	78. 6	27. 3	26. 6
313652	6. 5	71. 5	31. 1	27. 0
313652	6. 4	67. 7	31. 0	26. 5
313652	6. 5	71. 1	30. 8	28. 0
313652	6. 2	67. 1	29. 6	25. 6
313650	6. 0	68. 0	32. 0	28. 4
313650	6. 5	72. 9	34. 0	30. 3
313650	6. 5	63. 3	28. 6	24. 9
313650	6. 1	68. 3	29. 7	25. 6
313650	6. 3	74. 1	29. 1	25. 8
313650	6. 5	65. 8	29. 5	26. 9
313650	6. 8	75. 7	29. 8	28. 4
Average	6. 57	69. 89	29. 84	26. 8
Greatest	7. 5	78. 6	34. 0	30. 3
Least	6. 0	63. 3	25. 7	24. 4

COCHLOSTYLA (CHRYSALLIS) LICHENIFER (Mörch)

Shell of medium size, elongate-ovate, rather smooth. The early whorls are pale brown, the last one of considerably darker ground color marked by fulgurations of yellowish-white axial bands. Interior of aperture bluish white edged with purplish brown, which also forms a zone at the outer edge of the parietal callus, while the callus itself is of the same color as the interior of the aperture. The postnuclear whorls are slightly rounded, appressed at the summit, and marked by rather closely spaced lines of growth, which make the spaces between them look like flattened, slender, appressed threads. The entire surface of the shell is marked by numerous fine incised lines, which cross the lines of growth obliquely both protractively and retractively and give to the surface, under the microscope, a finely fenestrated pattern. The aperture is broadly ovate, oblique; the peristome is decidedly expanded all around and reflected over the parietal wall as a heavy callus.

I am recognizing two subspecies of this species: *Cochlostyla lichenifer lichenifer* (Mörch), which I have not seen, and *Cochlostyla lichenifer avittata,* a race of which a specimen was collected by Dr. Edgar A. Mearns on the Mount Halcon Expedition. The two races can be distinguished as follows:

KEY TO THE SUBSPECIES OF COCHLOSTYLA (CHRYSALLIS) LICHENIFER

Peripheral zone of brown present	**lichenifer**
Peripheral zone of brown absent	**avittata**

COCHLOSTYLA (CHRYSALLIS) LICHENIFER LICHENIFER (Mörch)

PLATE 110, FIGURE 5

1850. *Bulimus lichenifer* MÖRCH, Catalogus conchyliorum quae reliquit C. P. Kierulf . . ., pp. 6, 29, pl. 1, fig. 3.
1853. *Bulimus lichenifer* PFEIFFER, Monographia heliceorum viventium, vol. 3, pp. 322–323.
1859. *Bulimus electricus* PFEIFFER, Monographia heliceroum viventium, vol. 4, p. 389; in part.
1860. *Bulimus lichenifer* MARTENS, Albers, Die Heliceen, ed. 2, p. 321.
1868. *Bulimus electricus* PFEIFFER, Monographia heliceorum viventium, vol. 5, p. 35; in part.
1876. *Bulimus lichenifer* PFEIFFER, Monographia heliceorum viventium, vol. 7, p. 50; in part.
1877. *Cochlostyla electrica* SEMPER, Reisen im Archipel der Philippinen, pt. 2, vol. 3, pp. 222; in part.
1887. *Cochlostyla electrica* HIDALGO, Journ. Conchyl., vol. 35, p. 174; in part.
1892. *Cochlostyla electrica* PILSBRY, Man. Conch., ser. 2, vol. 8, pp. 53–54 (in part), pl. 15, fig. 5.
1895. *Helicostyla electrica* PILSBRY, Man. Conch., ser. 2, vol. 9, p. 231; in part.
1896. *Chrysallis electrica* ELERA, Catalogo sistematico de toda la fauna de Filipinas, vol. 3, p. 612; in part.
1897. *Cochlostyla lichenifer* HIDALGO, Journ. Conchyl., vol. 44, pp. 254, 281, 294.
1898. *Cochlostyla electrica* MÖLLENDORFF, Abh. Naturf. Ges. Görlitz, vol. 22, p. 147; in part.
1901. *Cochlostyla electrica* HIDALGO, Obras malacologicas, pl. 155, fig. 5(?).
1914. *Cochlostyla electrica* MÖLLENDORFF, KOBELT, and WINTER, Semper's Reisen im Archipel der Philippinen, vol. 10, pp. 339–340.
1932. *Cochlostyla* (*Chrysallis*) *lichenifer lichenifer* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 340.

Of *lichenifer* Mörch says: That it differs from *B. virgata* by having the shell opaque, more ventricose, and the axial lines conspicuous, the parietal callus heavy and white and the columellar fold oblique and twisted. He gives the length as 57 mm and the diameter as 25 mm. He describes varieties *a* and *b*. Of *a* he describes the shell as chestnut-color, the early whorls yellowish below, periostracum greenish yellow, marked by microscopic, wavy, closely spaced, transverse lines. There are a columellar and a peripheral band on the last whorl, which is also marked by oblique fulgurations, which are edged with yellow and covered with an inconspicuous periostracum. Peristome dark, even in semiadult specimens.

I have no specimens that can be referred to typical *Cochlostyla lichenifer*. A somewhat worn shell collected by Mearns belongs here but is sufficiently different to merit a distinct subspecific name.

COCHLOSTYLA (CHRYSALLIS) LICHENIFER AVITTATA Bartsch

PLATE 110, FIGURE 4

1932. *Cochlostyla* (*Chrysallis*) *lichenifer avittata* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 340.

Shell elongate-ovate, rather slender. The early whorls dark, the middle ones flesh-color with a brownish tinge, the last one dark brown. Upon this ground color are placed slightly retractively slanting fulgurations of pale flesh-colored axial bands having a yellowish tinge. The aperture is white with a livid tinge. The expanded peristome is bounded on the edge by a purplish zone, which also marks the edge of the parietal callus, the rest of the callus agreeing with the interior of the aperture. The postnuclear whorls are feebly rounded, appressed at the summit, and marked by very slender, retractively curved axial threads, which are closely approximated and decidedly flattened, so that the spaces between them appear as mere lines. This sculpture extends also over the base. In addition the entire surface of the shell is marked by numerous microscopic, rather closely approximated crisscross lines, which pass obliquely over the lines of growth and give to the surface of the shell, when viewed under high magnification, a finely fenestrated appearance. The aperture is broadly ovate, decidedly oblique; the peristome is broadly expanded and reflected. The peristome of the inner lip is widest at its base, where it continues over the parietal wall as a heavy callus.

The type (U.S.N.M. no. 382972) was collected by Col. Edgar A. Mearns on Mount Halcon, Mindoro. It has the early whorls broken; the four remaining measure: Length, 61.8 mm; greater diameter, 28 mm.

COCHLOSTYLA (CHRYSALLIS) ELECTRICA (Reeve)

Shell ovate. The first postnuclear whorls bluish, the rest flesh-color with the posterior half brown, which becomes the ground color of the rest of the turns. This ground color is covered by a periostracum of varying thickness and usually of yellowish tinge through which the axial fulgurations show. The aperture is brilliantly bluish white; peristome dark purplish brown at the edge gradually blending into the white of the interior. A zone of this color also covers the outer edge of the parietal callus, thus completely framing the aperture. The whorls are moderately rounded, appressed at the summit, and marked by fine retractively slanting lines of growth and numerous microscopic crisscross lines, which cross the lines of growth obliquely and give to the surface, under the microscope, a somewhat reticulated pattern, but the *distinctive features* of the species appear to be curious wavy interrupted axial hydrophanous lines and spots, which give to the surface of the shell a vermiculated appearance that I have not seen in any of the other species.

I have not seen the typical race from Puerto Galera and shall have to quote description and figures of this from Reeve. I have, however, two races from the southern end of the island—one from the east coast and one from the west coast—which are here described and figured. The following key will help to distinguish them:

KEY TO THE SUBSPECIES OF COCHLOSTYLA (CHRYSALLIS) ELECTRICA

Light fulgurations broad and protractively slanting.................. electrica
Light fulgurations narrow and retractively slanting.
    Periostracum very thin; shell ovate.......................... mangarina
    Periostracum thick; shell narrowly ovate.................. bulalacaoana

COCHLOSTYLA (CHRYSALLIS) ELECTRICA ELECTRICA (Reeve)

Plate 109, Figure 5

1841. *Bulinus mindoroensis* var. *k* Broderip, Proc. Zool. Soc. London, 1840, pp. 85–86.
1851. *Bulimus electricus* Reeve, Conchologia iconica, pl. 5, fig. 21.
1853. *Bulimus electricus* Pfeiffer, Monographia heliceorum viventium, vol. 3, p. 326.
1856. *Bulimus electricus* Pfeiffer, Malakozool. Blätter, vol. 2, p. 150.
1859. *Bulimus electricus* Pfeiffer, Monographia heliceorum viventium, vol. 4, p. 389: in part.
1860. *Chrysallis electrica* Martens, Albers, Die Heliceen, ed. 2, p. 179.
1876. *Bulimus electricus* Pfeiffer, Monographia heliceorum viventium, vol. 7, p. 50; in part.
1877. *Cochlostyla electrica* Semper, Reisen im Archipel der Philippinen, pt. 2, vol. 3, p. 222; in part.
1887. *Cochlostyla electrica* Hidalgo, Journ. Conchyl., vol. 35, p. 174.
1892. *Cochlostyla electrica* Pilsbry, Man. Conch., ser. 2, vol. 8, pp. 51, 53–54 (in part), pl. 15, fig. 4.
1895. *Helicostyla electrica* Pilsbry, Man. Conch., ser. 2, vol. 9, p. 231.
1896. *Cochlostyla electrica?* Elera, Catalogo sistematico de toda la fauna de Filipinas, vol. 3, p. 612; in part.
1897. *Cochlostyla electrica* Hidalgo, Journ. Conchyl., vol. 44, pp. 254, 263, 268, 281, 294, 330, 331, 341, 350.
1898. *Cochlostyla electrica* Möllendorff, Abh. Naturf. Ges. Görlitz, vol. 22, p. 147; in part.
1901. *Cochlostyla electrica* Hidalgo, Obras malacologicas, pt. 1, pp. 552–553; in part.
1914. *Cochlostyla electrica* Möllendorff, Kobelt, and Winter, Semper's Reisen im Archipel der Philippinen, vol. 10, pp. 339–340.
1932. *Cochlostyla* (*Chrysallis*) *electrica electrica* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 340.

"Shell somewhat elongately ovate, more ventricose in the middle, spire acuminate, whorls six in number, rather flatly convex, columella slightly twisted; livid red, epidermis rather thin, exhibiting very irregular obliquely waved pale streaks, aperture whitish, peritreme reddish brown.

"*Bulimus Mindoroensis*, var. *K*, Broderip.

"Hab. Puerto Galero, Island of Mindoro, Philippines (on the leaves of trees); Cuming.

"If any importance is to be attached to the character and pattern of the epidermis of these shells, there is certainly enough to distinguish this from the B. Mindoroensis. The epidermis is of a soft, very slight texture, of a uniform reddish brown tint in which light streaks descend here and there from the sutures in very zigzag course, somewhat as in B. fulgetrum but fainter; and, beside this, the shell is of a more acuminated growth, whilst the last whorl is larger and more effused."

This differs from the two races I have described by having the columella livid red; in the other two it is white edged with purplish brown.

Puerto Galera is in the northeastern part of the island. The other two came from the southeast and southwest, respectively.

COCHLOSTYLA (CHRYSALLIS) ELECTRICA MANGARINA Bartsch

Plate 109, Figures 1, 2

1892. *Cochlostyla electrica* Pilsbry, Man. Conch., ser. 2, vol. 8, pp. 51, 53–54 (in part), pl. 15, fig. 3.

1901. *Cochlostyla electrica* Hidalgo, Obras malacologicas, p. 553; in part.

1932. *Cochlostyla* (*Chrysallis*) *electrica mangarina* Bartsch, Journ. Washington Acad. Aci., vol. 22, p. 340.

Shell ovate. The first nuclear whorl is flesh-color; the rest have the posterior half brown. The postnuclear whorls are of bright chestnut-brown ground color, covered with a thin pale-gray periostracum, beneath which more or less continuous zigzag, retractively slanting, axial, flesh-colored fulgurations pass over the whorls. These are strongest developed near the summit, where they appear almost as false teeth. There is a smooth peripheral zone of brown, apparently devoid of periostracum. The aperture is bluish white and the expanded peristome is edged with pale chocolate-brown, gradually fading toward the interior of the shell. This zone of chestnut-brown also extends over the edge of the inner lip and the edge of the parietal callus, thus completely bounding the peritreme. Nuclear whorls 2.4, the first two well rounded and smooth, the last half of the last turn showing the beginning of the postnuclear sculpture. The postnuclear whorls are rather well rounded, appressed at the summit, and marked by very feeble lines of growth. The usual crisscross, microscopic, closely spaced, incised lines that cut the lines of growth obliquely both protractively and retractively and numerous closely spaced dots and wavy vermiculated lines of white are present both on the spire and base. The periphery is feebly obsoletely angulated. Base somewhat inflated, well rounded. The aperture is broadly oval; outer lip strongly expanded and reflected; the inner lip also is expanded and very broadly so at its insertion, and reflected over the umbilicus, which it leaves as an open chink. The lip continues into a heavy parietal callus, which renders the peritreme complete.

The type (U.S.N.M. no. 382973) was collected by Quadras at Sitio Brucaan, Mangarin, southwest Mindoro. It has 6.4 whorls and measures: Length, 56.9 mm; greater diameter, 29.2 mm.

This species differs from typical *C. electrica electrica* in being more globose and in having the axial fulgurations retractively slanting. It differs from *C. electric bulalacaoana* in being more globose and in having a much less heavy periostracum.

COCHLOSTYLA (CHRYSALLIS) ELECTRICA BULALACAOANA Bartsch

PLATE 109, FIGURE 3

1901. *Cochlostyla electrica* HIDALGO, Obras malacologicas, p. 553; in part.
1932. *Cochlostyla* (*Chrysallis*) *electrica bulalacaoana* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 340.

Shell elongate-ovate. The first postnuclear whorl white; the next one showing at the summit the beginning of a brown zone, which rapidly spreads over the entire portion of the nuclear turns at their termination. From there on the ground color of the shell is chestnut-brown. The entire surface of the shell is overlain by a heavy yellowish-olive periostracum except at the peripheral zone and certain spots near the summit of the shell where the brown substratum shines through. Through this periostracum retractively slanting, moderately broad, zigzag, axial fulgurations are visible. The interior of the aperture is bluish white. The broadly expanded periostracum is reddish chocolate-brown. This is also the color of the outer half of the inner lip and the broad zone, marking the edge of the parietal callus. Nuclear whorls 2.8, well rounded, smooth except for the last half of the last whorl, which shows the beginning of the postnuclear sculpture. The postnuclear whorls are slightly rounded, appressed at the summit and marked by feeble, closely spaced, flattened axial threads. The usual crisscross, obliquely placed, microscopic incised lines, which cut the lines of growth obliquely both protractively and retractively, are also present. There are also indications of fine spiral lines. In addition the surface is marked by fine, whitish, wavy vermiculations, which are closely spaced. These are best shown on the early postnuclear whorls, but become somewhat obscured in this race on the last turn. The base is marked like the spire. The aperture is broadly oval; outer lip broadly expanded and reflected; the inner lip is broadly expanded, especially at its insertion, and reflected over the umbilicus, which it leaves as a small chink. It extends over the parietal callus as a heavy callus, rendering the peritreme complete.

The type (U.S.N.M. no. 382974) was collected by Quadras at Boca de Cora, Bulalacao, southeastern Mindoro. It has 6.4 whorls and measures: Length, 61.2 mm; greater diameter, 30.6 mm.

The discussion of relationships with *C. electrica mangarina* will be found under that subspecies.

COCHLOSTYLA (CHRYSALLIS) PALLIOBASIS Bartsch

Plate 110, Figure 3

1932. *Cochlostyla* (*Chrysallis*) *palliobasis* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 340. (June.)
1932. *Helicostyla mcgintyi* Smith, Nautilus, vol. 46, p. 63, pl. 4, figs. 1, 2. (Oct.)
1933. *Helicostyla* (*Chrysallis*) *mindoroensis orotis* Clench and Archer, Papers Michigan Acad. Sci., Arts, Letters, vol. 17, p. 549, pl. 58, fig. 1.

Shell pupoid. The nuclear whorls are pale buff. The early postnuclear whorls are very pale brown, gradually deepening to light chestnut-brown on the last turn. This coloration stops abruptly at the periphery, and the base is buff shading gradually toward brown on the last half of the last turn. In addition to this ground color, the postnuclear whorls are fulgurated with rather broad hydrophanous olivaceous-buff axial markings. The anterior portion of the shell surrounding the umbilicus and the columella is blackish chestnut-brown. The interior of the aperture is bluish white, deepening on the outer lip and columella to decidedly bluish. Both the outer lip and the columella are edged with dark brown. The parietal wall is glazed with a thin translucent callus. Nuclear whorls 2.9, forming a moderately acute apex, well rounded, smooth, marked by retractively curved lines of growth and the last one by fine spiral striations. The postnuclear whorls are slightly rounded, appressed at the summit, and marked by retractively slanting lines of growth and fine, closely spaced, microscopic spiral striations, which are present on both spire and base. Aperture broadly oval; peristome broadly expanded and reflected. The columella is also broadly expanded at its insertion and reflected to form the narrow umbilicus.

This species is most conspicuously distinguished from all the others by having the basal half pale buff as contrasted with the chestnut coloration of the upper portion of the last whorl.

The type (U.S.N.M. no. 313653) collected by Pedro de Mesa at Pinagabyan, Paluan, Mindoro, has 7.2 whorls and measures: Length, 61.7 mm; greater diameter, 27.7 mm; lesser diameter, 22.5 mm.

Four topotypes, also collected by Mr. de Mesa, entered as U.S.N.M. no. 313656, yield the following data:

Number of whorls	Length	Greater diameter	Lesser diameter
	Mm	*Mm*	*Mm*
7.1	63.2	29.7	25.0
7.2	57.4	26.7	22.2
7.0	58.2	28.2	24.1
7.0	53.2	25.2	22.0
7.07 [1]	[1] 58.0	[1] 27.45	[1] 23.3
7.2 [2]	[2] 63.2	[2] 29.7	[2] 25.0
7.0 [3]	[3] 53.2	[3] 25.2	[3] 22.0

[1] Average. [2] Greatest. [3] Least.

COCHLOSTYLA (CHRYSALLIS) PETITI Bartsch

PLATE 109, FIGURE 4

1850. *Bulimus cailliaudi* PETIT, Journ. Conchyl., vol. 1, p. 404, pl. 13, fig. 3.
1853. *Bulimus cailliaudi* PFEIFFER, Monographia heliceorum viventium, vol. 3, p. 323.
1859. *Bulimus cailliaudi* PFEIFFER, Monographia heliceorum viventium, vol. 4, p. 383.
1876. *Bulimus cailliaudi* PFEIFFER, Monographia heliceorum viventium, vol. 7, p. 269.
1877. *Cochlostyla electrica* SEMPER, Reisen im Archipel der Philippinen, pt. 2, vol. 3, p. 222; in part.
1895. *Helicostyla electrica* PILSBRY, Man. Conch., ser. 2, vol. 9, p. 231; in part.
1896. *Chrysallis electrica* ELERA, Catalogo sistematico de toda la fauna de Filipinas, vol. 3, p. 612; in part.
1897. *Cochlostyla cailliaudi* HIDALGO, Journ. Conchyl., vol. 44, pp. 249, 250, 267, 268, 274, 281, 283, 293, 330, 335, 338, 351.
1898. *Cochlostyla electrica* MÖLLENDORFF, Abh. Naturf. Ges. Görlitz, vol. 22, p. 147; in part.
1901. *Cochlostyla electrica* var. *cailliaudi* HIDALGO, Obras malacologicas, pt. 1, pp. 552–553 (in part), pl. 113, fig. 3.
1914. *Cochlostyla electrica* MÖLLENDORFF, KOBELT, and WINTER, Semper's Reisen im Archipel der Philippinen, vol. 10, pp. 339–340; in part.
1932. *Cochlostyla* (*Chrysallis*) *pettiti* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 340.
1933. *Helicostyla mindoroensis cailliaudi* CLENCH and ARCHER, Papers Michigan Acad. Sci., Arts, Letters, vol. 17, pp. 545, 548–549.

The name *Bulimus cailliaudi* Petit, December 1850, was preoccupied by *Bulimus cailliaudi* Pfeiffer, published in August 1850 in the Zeitschrift für Malakozoologie, page 86, and I have rechristened it *Cochlostyla* (*Chrysallis*) *petiti*. I believe with previous authors that it comes near *Cochlostyla electrica* and *Cochlostyla lichenifer*, but I think that it is not specifically or even subspecifically related to either.

As I have not seen specimens, I copy Petit's description and figure.

"Shell oblong oval, very light. Interior of the aperture white, tinted with rose. Externally the shell is covered with a yellowish periostracum which is denser on the last whorl. Aperture very broad. The outer lip expanded and a little reflected, having the edge tawny rose colored, approaching the color of the dregs of wine.

"This species, which in some respects resembles *Bulimus sylvanus* and *Bulimus dryas*, has, nevertheless, characters of its own such as the presence of an umbilicus. Its texture too is less solid, and also differs in its number of whorls, its coloration and wider aperture."

COCHLOSTYLA (CHRYSALLIS) ROLLEI Möllendorff

Shell very large. The nuclear whorls are flesh-color; the postnuclear whorls are brown, variegated, streaked and spotted with yellowish or greenish-yellow axial bands. The surface is covered with a thin periostracum that allows the banding to show through. The nuclear whorls are marked with transverse wrinkles on all but the first portion of the first turn. The postnuclear whorls are marked by retractively slanting, threadlike, depressed, closely approximated lines of growth, which extend from the summit to the umbilical chink. In addition the whorls are marked by fine crisscross lines, cutting the lines of growth obliquely, both protractively and retractively, but these lines are very feebly expressed and scarcely perceptible, even under the microscope. The base also usually presents fine, poorly developed, closely spaced, incised, spiral lines. The aperture is large and broadly oval. The peristome is reflected and brown, both on the outer lip and the columellar side. The parietal wall is covered by a brown callus.

This species is represented by four races in our collection. The typical one, coming from the Mount Halcon region, is conic in shape, in which respect it resembles the small race whose habitat I am not familiar with, while the other large race is more globose, with the whorls more inflated and with stronger markings, and comes from the Lake Naujan country.

All three of these are chestnut-brown in ground color. The fourth, coming from Mayabig, Baco, Mindoro, is almost of black ground color on the last whorl, and all the whorls are darker.

KEY TO THE SUBSPECIES OF COCHLOSTYLA (CHRYSALLIS) ROLLEI

- Ground color chestnut-brown.
  - Shell large.
    - Shell elongate-ovate; axial bands narrow ---------- **rollei**
    - Shell ovate; axial bands broad ---------- **osborni**
  - Shell small ---------- **vexator**
- Ground color almost black ---------- **nigra**

COCHLOSTYLA (CHRYSALLIS) ROLLEI ROLLEI Möllendorff

PLATE 110, FIGURE 6

1892. *Cochlostyla mindoroensis* PILSBRY, Man. Conch., vol. 8, pp. 52–53, pl. 15, figs. 1, 2.
1898. *Cochlostyla rollei* MÖLLENDORFF, Abh. Naturf. Ges. Görlitz, vol. 22, p. 146.
1901. *Cochlostyla rollei* HIDALGO, Obras malacologicas, pp. 546–547; in part.
1914. *Cochlostyla rollei* MÖLLENDORFF, KOBELT, and WINTER, Semper's Reisen im Archipel der Philippinen, vol. 10, pp. 338–339, pl. 76, figs. 1–3.
1932. *Cochlostyla* (*Chrysallis*) *rollei rollei* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 340.
1933. *Helicostyla* (*Chrysallis*) *rollei* CLENCH and ARCHER, Papers Michigan Acad. Sci., Arts, Letters, vol. 17, p. 552.

Shell large, ovate. The early whorls are soiled flesh-color, those succeeding turning chestnut-brown and streaked with irregular areas of pale greenish yellow, hydrophanous, more or less interrupted axial bands, which vary in size and regularity. The aperture is bluish within; the peristome is pale brown, which is also the color of the parietal callus. The surface of the shell is covered by a very thin periostracum, which allows the markings referred to before to shine through. Nuclear whorls 3, well rounded, smooth. The postnuclear whorls are well rounded, very slightly narrowly shouldered at the summit, and marked by retractively slanting, rounded, threadlike lines of growth, which are closely approximated and of irregular strength. The fine crisscross sculpture obliquely cutting the lines of growth is very feebly expressed. This scupture also obtains on the base, where fine, closely spaced, microscopic, feebly incised spiral lines are also present. The periphery and base are inflated and well rounded. The aperture is large, very broadly oval. The peristome of the outer lip is thickened, expanded, and reflected. The peristome of the inner lip is also thickened and expanded, particularly at its insertion, where it continues over the parietal wall as a thick callus. The reflected inner lip leaves a broad umbilical chink.

This race differs from *Cochlostyla* (*Chrysallis*) *rollei osborni* in being more conic and less definitely streaked. It differs from *Cochlostyla* (*Chrysallis*) *rollei vexator* in being much larger, and from *Cochlostyla* (*Chrysallis*) *rollei nigra* in being much lighter.

The specimen described and figured is one of nine (U.S.N.M. no. 255868) collected by Col. Edgar A. Mearns on Mount Halcon, Mindoro. It has 6.2 whorls and measures: Length, 75.6 mm; greater diameter, 42 mm; lesser diameter, 34.2 mm. The other eight specimens yield the following measurements:

Number of whorls	Length	Greater diameter	Lesser diameter
	Mm	*Mm*	*Mm*
6.2	74. 5	42. 2	34. 3
6.0	68. 2	41. 3	34. 6
6.1	68. 3	40. 2	33. 8
6.0	63. 3	37. 8	32. 5
6.0	71. 2	41. 8	32. 8
6.0	67. 6	41. 1	32. 4
6.0	67. 7	38. 5	34. 0
6.1	71. 6	40. 7	34. 6

COCHLOSTYLA (CHRYSALLIS) ROLLEI OSBORNI Bartsch

PLATE 110, FIGURE 7

1901. *Cochlostyla rollei* HIDALGO, Obras malacologicas, pp. 546–547 (in part), pl. 127, figs. 1, 2.

1932. *Cochlostyla* (*Chrysallis*) *rollei osborni* BARTSCH, Journ. Washington Acad. Sci., vol. 22, pp. 340–341.

Shell large, ovate. The early whorls soiled flesh-color, the succeeding turns brown marked by rather broad, oblique, soiled yellow, more or less interrupted, and sometimes fulgurated axial bands. The aperture is pearly within, the peristome of the outer and inner lips and parietal callus being brown. The nuclear whorls are well rounded and marked by transverse closely spaced wrinkles, which really represent the beginning of the postnuclear sculpture. The postnuclear whorls are inflated and strongly rounded and very narrowly shouldered at the summit. They are marked by closely spaced, low, rather irregular, retractively slanting, threadlike riblets, which are about as wide as the spaces that separate them and which extend from the summit to the umbilical chink. In addition the surface of the shell is marked by fine crisscross sculpture, which passes obliquely over the axial threads. The incised spiral lines on the base are scarcely perceptible. The periphery is marked by an obsolete angle. The aperture is very broadly ovate. The outer lip moderately expanded and reflected. The inner lip is broadly reflected at its insertion; the parietal wall is covered by a moderately thick callus.

The type (U.S.N.M. no. 300823) was collected by Dr. Osborn at Lake Naujan, Mindoro. It has 6.1 whorls and measures: Length, 70.3 mm; greater diameter, 42.2 mm.

Two additional specimens (U.S.N.M. no. 313550), also from the Lake Naujan region, were collected by the Worcester and Bourns expedition; they have 6 whorls each and measure: Length, 71.5 and 71.3 mm; greater diameter, 40.2 and 44 mm, respectively.

COCHLOSTYLA (CHRYSALLIS) ROLLEI VEXATOR Bartsch

Plate 110, Figure 1

1932. *Cochlostyla* (*Chrysallis*) *rollei vexator* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 341.

Shell small, ovate. The nuclear whorls are flesh-color; the early postnuclear whorls also flesh-color with a narrow zone of brown at the summit. The antepenultimate whorl is pale brown, shading rapidly to chestnut-brown on the last turn. The interior of the aperture is pearly gray with the peristome bright chestnut-brown, which is also the color of the parietal callus. The early whorls have slight indication of axial lighter zones, particularly at the summit, where they appear as slender false teeth. The later whorls, particularly the last one, are crossed by strongly marked, oblique, pale greenish-yellow, axial bands, which vary considerably in width and regularity of outline. Nuclear whorls 2.3, well rounded, the last portion showing the beginning of the postnuclear threadlike sculpture. The postnuclear whorls are only moderately rounded, slightly shouldered at the summit, and crossed by numerous rather irregular, retractively slanting, threadlike riblets, which give to the surface of the shell a rather rough and somewhat shaggy appearance. There are also indications of poorly expressed, fine, spiral striations, which are best shown on the base. The fine zigzag sculpture is exceedingly minute. Aperture oval; outer lip moderately expanded and reflected; the inner lip partly expanded at its insertion where it flows into the parietal callus.

The type (U.S.N.M. no. 104348) was received from the Lea collection and is labeled *Helix mindoroensis*, without specific locality label. It has 6.2 whorls and measures: Length, 57.7 mm; greater diameter, 30.8 mm.

This is an exceedingly small race undoubtedly belonging to the *rollei* complex.

COCHLOSTYLA (CHRYSALLIS) ROLLEI NIGRA Bartsch

PLATE 110, FIGURE 2

1932. *Cochlostyla (Chrysallis) rollei niger* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 341.

Shell huge, ovate. The early nuclear whorls are flesh-color, the succeeding ones pale chestnut-brown, which is also the color of the first two postnuclear whorls, the last one being very dark, almost blackish, brown. The postnuclear whorls are covered by a rather strong periostracum, which is marked by hydrophanous bands of varying widths and shape, the pattern of the basal portion being frequently quite different from that of the spire. The hydrophanous markings are olivaceous-buff. The interior of the aperture is pale blue; the peristome is very dark chocolate-brown, which is also the color of the outer edge of the columella, the inner portion of the columella gradually changing through smoky gray to bluish white at its inner edge. Nuclear whorls 3, the first almost flattened, moderately rounded, the succeeding turns moderately rounded and marked by incremental lines, which gradually increase in strength. The last whorl also shows incised spiral lines. The postnuclear whorls are somewhat inflated, well rounded, appressed at the summit, and marked by retractively curved, threadlike, incremental lines and numerous rather strong incised spiral striations and the usual crisscross sculpture, which here also is somewhat intensified and present on both spire and base. The suture is moderately impressed. The periphery is obsoletely angulated. The base is inflated, strongly rounded, and rather openly umbilicated. The aperture is broadly oval; the outer lip is expanded and reflected. The inner lip also is broadly expanded and reflected, half covering the umbilicus. The parietal wall is covered by a rather thick callus.

This race differs from the other three races in being much darker and in having the spiral sculpture decidedly more pronounced.

The type (U.S.N.M. no. 313721) was collected by Pedro de Mesa at Mayabig, Baco, Mindoro. It has 6 whorls and measures: Length, 70.1 mm; greater diameter, 42.3 mm; lesser diameter, 33.8 mm.

The following specimens yield additional data:

U.S.N.M. no.	Number of whorls	Length	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
313661	6.0	69.1	37.0	31.0
313661	5.6	62.1	38.7	33.0
313661	5.6	68.3	37.5	33.1
313661	5.0	65.4	40.4	33.8
313661	5.7	69.9	37.7	33.4
313661	5.3	70.9	39.9	33.5
313661	5.5	68.2	40.9	34.2
313661	5.6	75.2	39.7	35.0
313661	5.8	78.7	45.7	37.3
313661	5.7	73.5	41.0	34.1
313661	5.5	75.4	40.3	34.4
313661	5.2	62.8	35.2	29.5
313661	5.3	66.5	38.4	32.8
313661	5.6	74.1	40.8	32.8
313661	5.1	68.6	41.6	36.0
313661	5.5	71.8	38.9	34.5
313661	5.2	65.7	39.4	33.6
313661	5.1	65.2	36.7	31.8
313661	5.2	63.1	36.7	32.4
313697	5.4	75.4	43.1	37.0
313697	5.6	71.5	41.0	36.3
313697	5.2	72.7	42.1	37.0
313697	5.3	75.0	41.9	35.5
313697	5.4	68.1	40.0	34.7
313697	5.7	77.5	40.4	34.7
313697	5.5	67.4	39.5	34.4
313697	5.5	66.9	39.8	34.2
313697	5.4	67.5	37.6	32.7
313697	5.6	74.2	43.7	37.5
Average	5.45	70.0	39.85	34.14
Greatest	6.0	78.7	45.7	37.5
Least	5.0	62.1	35.2	29.5

COCHLOSTYLA (CHRYSALLIS) ALBOLABRIS Bartsch

1932. *Cochlostyla* (*Chrysallis*) *albolabris* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 341.

Shell of medium size. The nuclear whorls are flesh-color; the early postnuclear whorls have a narrow zone of brown at the summit. The later ones are of chestnut-brown ground color, marked by variously slanting axial zones and fulgurations of yellowish buff, which extend to the umbilical region in the last whorl. Interior of the aperture bluish white, with the peristome white, bearing, however, at the very edge a brownish zone. The early nuclear whorls are smooth; the later ones marked by growth lines. The postnuclear whorls are somewhat inflated, rather strongly rounded, narrowly shouldered at the summit, and marked by retractively slanting lines of growth, which are rather irregular and irregularly spaced. They are not quite threadlike. The usual fine zigzag sculpture cuts these lines obliquely, both protractively and retractively, on both spire and base. The aperture is rather large, oval. The outer lip is reflected and expanded; inner lip also expanded, particularly at its insertion, where it is reflected over the umbilicus leaving only a narrow open chink. The parietal wall is covered with a moderately strong callus.

This species is most nearly related to *Cochlostyla rollei*, from which it differs in having the peristome white and the aperture larger and in being much smaller.

There are apparently two races before me, one specimen of which was collected by Cuming and the other by Lieutenant Febiger. Neither one bears locality data.

KEY TO THE SUBSPECIES OF COCHLOSTYLA (CHRYSALLIS) ALBOLABRIS

Shell ovate	**robusta**
Shell elongate-ovate	**albolabris**

COCHLOSTYLA (CHRYSALLIS) ALBOLABRIS ROBUSTA Bartsch

Plate 111, Figure 5

1932. *Cochlostyla* (*Chrysallis*) *albolabris robusta* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 341.

Shell moderately large, ovate, rather stout. Only the last two nuclear whorls remain, the first one being lost. The first postnuclear whorl is buff with a narrow zone of brown; the succeeding postnuclear whorls are chestnut-brown, variegated with zones and fulgurations of yellowish buff, which are, however, very poorly developed in this race, showing best on the posterior half of the turns, the base being more or less uniform brown. Aperture bluish white within. This coloration also extends over the expanded peristome, but there is a very narrow zone of brown bordering the outer lip and the columella. The postnuclear whorls are marked by rather strong, retractively slanting, almost threadlike incremental lines, which give to the surface of the shell a roughish appearance. These lines extend to the umbilical chink in the last turn. They are crossed by the fine microscopic zigzag sculpture, on both spire and base. There are also indications of feebly expressed fine spiral incised lines. The aperture very broadly oval; the outer lip strongly expanded and reflected; the inner lip also expanded—decidedly so at its insertion—where it is reflected over the umbilicus, of which it leaves only a chink. The parietal wall is covered by a rather heavy glaze.

The type (U.S.N.M. no. 104347) has lost its first whorl. The 5.1 remaining measure: Length, 63.5 mm; greater diameter, 37.9 mm.

The specimen was collected by Lieutenant Febiger. It has no specific locality data with it.

COCHLOSTYLA (CHRYSALLIS) ALBOLABRIS ALBOLABRIS Bartsch

PLATE 111, FIGURE 6

1932. *Cochlostyla* (*Chrysallis*) *albolabris albolabris* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 341.

Shell elongate-ovate. The nuclear whorls white; the early postnuclear whorls buff with a narrow brown band at the summit; the rest of the postnuclear whorls chestnut-brown marked by bands of yellowish buff, which vary decidedly in slant. On some parts of the whorls they are protractively and on other parts retractively slanting. They are also of irregular width and spacing and extend on the last turn from the summit to the umbilicus. Interior of aperture white with a bluish tinge. This color extends over the expanded peristome to the very edge, which is brownish. The shell is covered by a very thin periostracum. Nuclear whorls 3, the first well rounded, smooth; the next showing the beginning of lines of growth, which become intensified on the last nuclear whorl where they practically merge into the postnuclear sculpture. The postnuclear whorls are marked by irregular lines of growth, which scarcely merit the term of threads. These are of irregular strength and spacing. They are also marked by microscopic crisscross sculpture, which cuts these lines of growth obliquely, both protractively and retractively, both on spire and base. The aperture is moderately large. The outer lip is expanded and reflected; the inner lip also expanded, broadly so at its insertion where it is reflected and leaves only a chink of the umbilicus. The parietal wall is covered by a thin callus, which permits the color pattern of the parietal wall to shine through, which protects the color pattern of the parietal wall with a translucent glaze.

The type (U.S.N.M. no. 104346) has 6.1 whorls and measures: Length, 61 mm; greater diameter, 32.7 mm.

COCHLOSTYLA (CHRYSALLIS) ANTONI Semper

Shell ovate to elongate-ovate, varying in the known races from ovate to elongate-ovate. The nuclear turns and the early postnuclear whorls are flesh-color; the later turns are straw-color with hydrophanous bands of a little paler or darker shade. The entire surface of the shell is covered by a thin greenish-yellow periostracum. The aperture is white within and also white on the reflected peristome. The nuclear whorls are well rounded. The postnuclear whorls are marked by retractively slanting lines of growth, which are irregular in strength and spacing. There are also fine, somewhat crinkly, feebly incised, spiral lines present on spire and base, and the entire surface is marked by the fine crisscross incised lines that cross the lines of growth obliquely. The aperture is rather large, broadly ovate, almost subcircular, with the peristome very broadly expanded and reflected. The peristome of the inner lip is very broadly expanded and reflected over the umbilicus, which it leaves as a narrow chink. The parietal wall is covered by a moderately thick callus.

I am recognizing two subspecies: One from the northern end of the island and the other from the southwestern part. The following key will readily help to distinguish them:

KEY TO SUBSPECIES OF COCHLOSTYLA (CHRYSALLIS) ANTONI

Shell stout	antoni
Shell slender	macilenta

COCHLOSTYLA (CHRYSALLIS) ANTONI ANTONI Semper

PLATE 111, FIGURE 1

1877. *Cochlostyla antoni* SEMPER, Reisen im Archipel der Philippinen, vol. 3, pt. 2, p. 223.
1891. *Cochlostyla antoni* HIDALGO, Obras malacologicas, pp. 547–548, pl. 105, fig. 1.
1892. *Cochlostyla chrysalidiformis antoni* PILSBRY, Man. Conch., ser. 2, vol. 8, p. 52.
1895. *Helicostyla chrysalidiformis antoni* PILSBRY, Man. Conch., ser. 2, vol. 9, p. 231.
1896. *Cochlostyla chrysalidiformis antoni* ELERA, Catalogo sistematico de toda la fauna de Filipinas, vol. 3, p. 611.
1897. *Cochlostyla antonii* HIDALGO, Journ. Conchyl., vol. 44, pp. 263, 281.
1898. *Cochlostyla antoni* MÖLLENDORFF, Abh. Naturf. Ges. Görlitz, vol. 22, p. 147.
1914. *Cochlostyla antoni* MÖLLENDORFF, KOBELT, and WINTER, Semper's Reisen im Archipel der Philippinen, vol. 10, pp. 340–341, pl. 75, figs. 7, 8.
1932. *Cochlostyla* (*Chrysallis*) *antoni antoni* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 341.

Shell broadly ovate. The early whorls are white, gradually grading into the pale yellow of the last turn, which on the base assumes practically a lemon shade. The postnuclear whorls are also crossed by rather distantly spaced, hydrophanous, retractively slanting zones, which become less conspicuous when the periostracum is worn away. The interior of the aperture is white, which is also the color of the broadly reflected peristome. Nuclear whorls 2.8, well rounded, smooth, except the last turn and a half, which show fine incremental lines. The postnuclear whorls are appressed at the summit, moderately rounded, marked by rather irregularly developed and spaced, retractively slanting, incremental lines and fine feebly incised spiral lines, which are present on both spire and base. In addition there are present microscopic, crisscross, incised spiral lines, which cross the lines of growth obliquely. The periphery is well rounded, the base somewhat inflated. Aperture large, very broadly oval; the peristome broadly expanded and reflected; that of the inner lip very broad at the insertion of the columella and reflected over the umbilicus, which appears only as a chink. A moderately thick callus connects the columella with the outer lip on the parietal wall.

The specimen described and figured (U.S.N.M. no. 315638) is one of two from the Evezard collection and is without specific locality data. It has 7 whorls and measures: Length, 68.5 mm; greater diameter, 36.1 mm. The other specimen has 6.9 whorls and measures: Length, 64 mm; greater diameter, 35.7 mm.

This race can readily be distinguished from the next by its much more ovate outline and more inflated whorls.

COCHLOSTYLA (CHRYSALLIS) ANTONI MACILENTA Bartsch

Plate 111, Figure 2

1914. *Cochlostyla antoni* Möllendorff, Kobelt, and Winter, Semper's Reisen im Archipel der Philippinen, vol. 10, pl. 75, fig. 8.

1932. *Cochlostyla* (*Chrysallis*) *antoni macilenta* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 341.

Shell very elongate-ovate, thin. The early whorls are flesh-color gradually changing to pale lemon-yellow, marked by feeble, retractively slanting, axial, hydrophanous bands, which sometimes assume the form of fulgurations, and by very fine vermiculations, which are more or less axially disposed, a character in which this race resembles the races of *Cochlostyla electrica.* A very thin periostracum covers the entire surface of the shell. Nuclear whorls 3; the first is well rounded; from the second on, slender axial lines of growth become apparent. The postnuclear whorls are very slightly rounded, appressed at the summit, and marked by feeble, retractively slanting, somewhat wavy, lines of growth, which vary considerably in strength and spacing. There are also feeble, irregularly disposed, incised, spiral lines present, as well as the microscopic crisscross lines passing obliquely over the lines of growth. All these elements are present on spire and base. Periphery well rounded. The base is well rounded. Aperture broadly oval; peristome broadly expanded and reflected; the inner lip also broadly expanded, very much so at its insertion, where the reflected portion almost covers the umbilicus, leaving only a chink. The parietal wall is covered by a thick white callus.

The type (U.S.N.M. no. 313551) was collected by Quadras at Sitio Brucaan, Mangarin, Mindoro. It has 6.9 whorls and measures: Length, 63 mm; greater diameter, 32.4 mm.

This subspecies can readily be distinguished from *Cochlostyla antoni antoni* by its much slenderer form and also by the presence of vermiculations alluded to, which may some day cause it to be considered a distinct species.

COCHLOSTYLA (CHRYSALLIS) ROSEOLABRA Bartsch

Shell varying from elongate-conic to broadly ovate. The color varies from yellowish buff to pale wood brown; the early whorls are always lighter than the later ones. The interior of the aperture may be bluish white or bluish white with a purplish tinge, and the peristome may be pale rose-color or bright rose-color, varying with the subspecies in question. The shell is covered with a thin periostracum, which bears hydrophanous lines. These are most conspicuous near the summit of the whorls, which they render falsely toothed. Nuclear whorls almost 3, forming a blunt apex, marked by retractively curved axial lines of growth, which are strongest on the last turn. Here they assume almost the strength of those of the postnuclear whorls. The postnuclear whorls are moderately well rounded, appressed at the summit, marked in one of the races by rather strong, retractively curved, incremental lines. In fact in this race they almost resemble threads, while in the other this sculpture is decidedly reduced in strength and the shell is almost smooth. The periphery of the last whorl is feebly angulated. The base is rather inflated and strongly rounded. The periphery is broadly oval; the peristome is expanded and reflected. The inner lip also is reflected, the reflection forming a narrow umbilicus.

The species, as far as known at present, is confined to northwestern Mindoro. I am recognizing two subspecies, but there is an indication of still another one.

KEY TO THE SUBSPECIES OF COCHLOSTYLA (CHRYSALLIS) ROSEOLABRA

General color of shell yellowish buff	roseolabra
General color of shell wood brown	rosea

COCHLOSTYLA (CHRYSALLIS) ROSEOLABRA ROSEOLABRA Bartsch

Plate 111, Figure 4

1932. *Cochlostyla (Chrysallis) roseolabra roseolabra* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 341. (June.)

1932. *Helicostyla chrysalidiformis calawaganensis* Smith, Nautilus, vol. 46, p. 64, pl. 4, figs. 4, 6. (October.)

1933. *Helicostyla (Chrysallis) mindoroensis flavipellis* Clench and Archer, Papers Michigan Acad. Sci., Arts, Letters, vol. 17, p. 548, pl. 18, fig. 5.

The shell is ovate. The early whorls are pale buff, the later ones buff with a yellowish tinge, marked by varicial streaks of pale brown, which are of irregular width and spacing. The postnuclear whorls are moderately curved with a thin olivaceous-yellow periostracum, which shows hydrophanous, retractively slanting, axial bands that give to the summit of the turns a smooth falsely toothed appearance. The interior of the aperture is bluish white, pearly. The broadly expanded peristome is pale rose-color. Nuclear whorls almost 3, forming a moderately acute apex. The first two are marked by fine incremental lines, the last one by stronger lines of growth. In fact, on this whorl the sculpture is as strong as that of the postnuclear turns. The postnuclear whorls are appressed at the summit, moderately strongly rounded, and marked by retractively slanting, incremental lines, which almost assume the strength of threads. They are rather irregular in strength and spacing. In addition there are rather coarse, incised spiral lines and the usual fine crisscross sculpture, which is extremely reduced in this race but is present on both spire and base. The periphery is feebly angulated, and the base is inflated and strongly rounded. The aperture is broadly oval. The peristome is decidedly expanded and reflected, the inner lip being reflected to form a moderately large umbilicus. The parietal wall is covered by a thin translucent callus.

This subspecies is distinguished from *Cochlostyla* (*Chrysallis*) *roseolabra rosea* by having the color of the lip and the general coloration much paler, as well as by the presence of incised spiral lines.

The type (U.S.N.M. no. 313677), collected by Pedro de Mesa at Calawagan, Paluan, Mindoro, has 5.9 whorls and measures: Length, 60 mm; greater diameter, 31.5 mm; lesser diameter, 27.9 mm.

Six topotypes (U.S.N.M. no. 313678) and 18 additional specimens yield the following measurements:

U.S.N.M. no.	Number of whorls	Length	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
313678	6. 1	62. 7	31. 0	26. 6
313678	5. 9	55. 1	25. 1	23. 0
313678	5. 1	45. 2	26. 4	24. 0
313678	5. 2	54. 5	29. 9	26. 1
313678	5. 7	56. 3	28. 5	25. 1
313678	5. 9	54. 9	27. 9	24. 6
313646	5. 8	51. 5	26. 6	23. 3
313646	6. 4	63. 5	31. 7	27. 2
313646	6. 0	52. 1	25. 4	23. 0
313646	5. 9	61. 5	32. 3	28. 4
313646	5. 4	58. 0	24. 7	24. 8
313646	5. 5	48. 5	26. 0	23. 2
313646	5. 5	53. 6	26. 8	24. 8
313646	5. 3	49. 6	29. 7	25. 2
313646	5. 2	46. 4	25. 6	23. 4
313643	5. 5	53. 0	28. 8	26. 4
313643	6. 0	57. 9	26. 4	22. 0
313643	5. 9	56. 9	27. 7	24. 1
313643	5. 4	47. 5	26. 3	23. 0
313643	5. 2	50. 3	28. 5	25. 2
313679	5. 0	45. 1	27. 0	24. 3
313679	5. 3	46. 9	27. 0	23. 6
313679	5. 7	49. 6	25. 9	23. 7
313679	5. 1	50. 2	28. 0	24. 1
Average	5. 58	52. 95	27. 6	24. 5
Greatest	6. 4	63. 5	32. 3	28. 4
Least	5. 0	45. 1	24. 7	22. 0

COCHLOSTYLA (CHRYSALLIS) ROSEOLABRA ROSEA Bartsch

PLATE 111, FIGURE 3

1932. *Cochlostyla* (*Chrysallis*) *roseolabra rosea* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 341.

Shell of medium size, ovate. The first two nuclear whorls are flesh-color, the last one pale wood brown. The postnuclear whorls are pale wood brown covered with a thin translucent pale-brown periostracum, which is marked by buff, hydrophanous, retractively slanting, axial bands and fulgurations that extend to the umbilical area of the base. These bands vary in width and spacing in different individuals. In some they are almost confluent. The aperture is bluish white with a purplish tinge within. The outer lip is bright rose-red, becoming more intense toward the outer edge. The same holds true of the columella. Nuclear whorls almost 3; the first is marked by lines of growth only, which become intensified until they almost form threads on the last portion of the last nuclear whorl. The nuclear spire is moderately acute. The postnuclear whorls are moderately rounded, appressed at the summit, and marked by retractively slanting, almost threadlike, axial lines of growth and feebly expressed spiral striations and by fine crisscross sculpture, which cuts the lines of growth obliquely. All these elements are present on both spire and base. Suture moderately constricted. Periphery obtusely angulated; aperture ovate. The outer lip is expanded and reflected; the inner lip also expanded, particularly at its insertion, and reflected to form the narrow umbilicus. The parietal wall is covered by a moderately thick callus.

The type (U.S.N.M. no. 313680), collected by Pedro de Mesa in the interior of Abra de Ilog, northwest Mindoro, has 6.3 whorls and measures: Length, 49.3 mm; greater diameter, 26.4 mm; lesser diameter, 22.6 mm.

Five topotypes (U.S.N.M. no. 313681) yield the following additional measurements:

Number of whorls	Length	Greater diameter	Lesser diameter
	Mm	*Mm*	*Mm*
6. 4	53. 4	27. 1	23. 7
6. 4	54. 6	29. 0	24. 3
6. 0	47. 5	24. 8	20. 8
6. 1	49. 7	26. 7	22. 3
5. 9	45. 2	26. 2	22. 4
6. 16 [1]	[1] 50. 0	[1] 26. 76	[1] 22. 7
6. 4 [2]	[2] 54. 6	[2] 29. 0	[2] 24. 3
5. 9 [3]	[3] 45. 2	[3] 24. 8	[3] 20. 8

[1] Average. [2] Greatest. [3] Least.

I also have before me four specimens (U.S.N.M. no. 313655) collected by Pedro de Mesa at Calawagan, Paluan, Mindoro. These are in every way darker than the others but may belong here. More material, however, will decide the fate of this element.

The shells that have been listed under the name *Cochlostyla mindoroensis* (Broderip) belong to two phylogenetic stocks as evidenced by the color of their nuclear whorls, which are embryonic features. In one group we have a soiled-white tip; in the other, a purplish-brown tip.

Before adequate material was at hand I believed that we might be dealing with a hybrid mutating complex, resulting in the many forms that the island presents, but the constancy of the color of the nucleus, combined with equally constant sculptural characters and general color pattern in the material gathered from certain areas, convinces me that this is not the case. For any other groups, such as *Cerion*, where I have found hybridization to be the source of mutation where different colored embryonic whorls were present, the progeny showed those characters, that is, white or buff tipped in the offspring, without any relation to the rest of the shell characters; in other words, a light tip, let us say, a character of Species A, would appear on a shell having all the rest of the characters of the other pattern Species B, which has a buff tip, the color of the nucleus only indicating the relationship to Species A.

No such mix-ups are present here, and if the many forms of the variegated Cochlostylas of Mindoro are the product of hybridization, then this must have taken place so long ago that complete segregation and fixation have taken place.

We have a similar situation presented in *Amphidromus* in southern Palawan and the adjacent small islands of that region, where *Amphidromus quadrasi* and its races always have a white tip in their colony regardless of the other color features, and *Amphidromus versicolor* in all its races has a dark apex. Among thousands of specimens examined of these two species I have been unable to detect an exception. Each colony usually occupies a distinct island or, in the case of the large island Palawan, a distinct portion of it, and all its members definitely align themselves with one or the other species.

It is my firm belief that the Mindoro Cochlostylas present a similar state of affairs and that in the past naturalists lumped shells of a general resemblance in the catch-all *Cochlostyla mindoroensis* because they had insufficient material without definite locality labels as typified by the old collections in the National Museum. An examination of a large series of specimens from a given locality will show that they definitely belong to the light- or dark-tipped forms. A separation on this basis makes it easily possible to trace these over the island where each group breaks up into zoogeographic races.

I shall therefore consider that the nuclei proclaim two phylogenetic groups, which I shall call species and under which I shall recognize the known races, as subspecies. How constant these races are may be inferred from plate 115 representing *Cochlostyla caniceps caniceps*, in which I show a series of specimens taken at random from a collection made at Lake Naujan, to illustrate the constancy of character.

COCHLOSTYLA (CHRYSALLIS) ASPERSA (Grateloup)

It is unfortunate that this species cannot carry the name *Cochlostyla mindoroensis* under which the various races belonging to it are reposing in the existing collections. Grateloup evidently received from Cuming some specimens labeled *Bulimus mindoroensis* (Broderip) but he did not approve of this name and gave the species the name *Bulimus aspersa*, defining it, in the Actes de la Société Linnéenne, volume 11, page 164, in 1840, in a very few words and mentioning Manila as its habitat. A little later, in the same year and publication, pages 421-422, he redefines it and figures it on plate 4 as figure 3, in an unmistakable manner. He also here places as variety *A* his *Bulimus wagneri*, which in the previous paper he had believed to have come from Peru. Broderip's *Bulinus mindoroensis*, not being published until the following year, must necessarily, for priority reason, give way to Grateloup's older name.

In recognizing a number of zoogeographic races in the island of Mindoro of *Cochlostyla aspersa*, I am going to retain the name *mindoroensis* for one of the races, the one coming from the region of Puerto Galera, which agrees best with Reeve's figure, published on plate 4, figure 15, in the Conchologia Iconica. Reeve, being the first one to figure a representative under this name, may be considered as fixing it to the form in question, since Broderip has given us the wide range of varieties *a-k* in the definition of his species.

I am also retaining Grateloup's name *wagneri* for a somewhat smaller and more elongate race from the region of Lake Naujan, probably from one of the hills on the east coast of the lake. Most of the specimens that I am referring to *Cochlostyla mindoroensis wagneri* in our collection are labeled merely, if labeled at all, Lake Naujan. The largest series was obtained by the Menage Expedition of Worcester and Bourns. I am led to retain *wagneri* because a large series of specimens collected by Mr. de Mesa at Ariod, some little distance northwest of Lake Naujan, are larger and represent typical *Cochlostyla aspersa*. Some of the Worcester and Bourns collections labeled Naujan belong to this larger, more globose, and chubby race, although they are also labeled Lake Naujan. This makes me believe that they represent a different habitat from that occupied by *Cochlostyla aspersa wagneri*.

Mr. de Mesa has transmitted to us also a splendid series of specimens from Mount Sapol, which are referable to *Cochlostyla aspersa melanogaster* (Mörch), and has sent also a fine lot of a huge subspecies that I am calling *Cochlostyla* (*Chrysallis*) *aspersa lunai*, collected at Calamintao, on the west slope of Mount Halcon. This in some respects suggests *Cochlostyla* (*Chrysallis*) *rollei* but has always a dark tip and ranges with this species rather than with *rollei*.

Another race discovered by Pedro de Mesa I am calling *Cochlostyla* (*Chrysallis*) *aspersa juani*, which is the smallest of the races so far discovered and comes from Camorong, Municipality of Abra de Ilog, Mindoro.

In addition to these older forms, whose names I am salvaging, there are several additional recognizable races that are elongate-ovate in form with the base more protracted than in the other races. One of these was gathered by Colonel Mearns on the slopes of Mount Halcon. I have named this *Cochlostyla* (*Chrysallis*) *aspersa edgari*. Another, collected by Mr. de Mesa at Abra de Ilog, I have named *Cochlostyla* (*Chrysallis*) *aspersa ilogana*, and a third, also collected by Mr. de Mesa on Mount Calavite, I call *Cochlostyla* (*Chrysallis*) *aspersa calavitana*. Still another I am calling *Cochlostyla* (*Chrysallis*) *aspersa binuangana*, from Binuangan, Muncipality of Paluan, northwest Mindoro.

The species may be defined as follows:

Shell varying in form from ovate to elongate-ovate. The base may be short and well rounded or protracted and less rounded. The nuclear whorls are always dark. There is usually between the nucleus and the last whorl a lighter turn or more, the last whorl being again darker than the preceding whorls. The shells are covered with a moderately thick periostracum, which may be mottled, streaked, fulgurated, spotted, and blotched with various shades of buff, yellow, or even orange. The base in some of the races is darker than the space between the summit and the periphery of the last whorl. The aperture varies from white to bluish white within, while the peristome ranges from pale chocolate to almost black with an azurite iridescence. The inner margin of the columella is usually white at its insertion, though in some instances this almost disappears. The nuclear whorls vary slightly in number, but they are never greatly removed from three turns. The first nuclear whorl is smooth, while the last shows the postnuclear sculpture, the intermediate elements being a gradation. The postnuclear whorls are moderately rounded, appressed at the summit, and almost smooth, being marked with somewhat irregular incremental lines and, in some of the races, indications of spiral striations. In addition the fine crisscross sculpture characteristic of most Cochlostylas, crossing the lines of growth obliquely, both protractively and retractively, is present here. The aperture varies from broadly ovate to elongate-ovate. The peristome is broadly expanded and reflected and very wide at the insertion of the columella, where it is reflected over the umbilicus that it almost covers. The species apparently ranges all over the island and breaks up into the zoogeographic races discussed above.

The following key will help to differentiate the races:

KEY TO THE SUBSPECIES OF COCHLOSTYLA (CHRYSALLIS) ASPERSA

- Base of last whorl not protracted.
  - Shell ovate.
    - Shell large.
      - Lip almost black ---------- lunai
      - Lip not almost black.
        - Lip with a decidedly bluish tinge ---------- aspersa
    - Shell small ---------- juani
  - Shell not ovate.
    - Shell elongate-ovate.
      - Color of base conspicuously darker than the rest of the last whorl.
        - Shell gibbose ---------- mindoroensis
        - Shell not gibbose.
          - Shell slender ---------- melanogaster
      - Color of base not conspicuously darker than the rest of the last whorl ---------- wagneri
- Base of last whorl protracted.
  - Shell elongate-ovate.
    - Ground color of last whorl chocolate-brown ---------- edgari
    - Ground color of last whorl blackish brown ---------- binuangana
  - Shell not elongate-ovate.
    - Shell large ---------- ilogana
    - Shell small ---------- calavitana

COCHLOSTYLA (CHRYSALLIS) ASPERSA LUNAI Bartsch

PLATE 112, FIGURE 7

1932. *Cochlostyla* (*Chrysallis*) *aspersa lunai* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 341.

1933. *Helicostyla* (*Chrysallis*) *mindoroensis* CLENCH and ARCHER, Papers Michigan Acad. Sci., Arts, Letters, vol. 17, p. 544; in part.

Shell large. The nuclear whorls are brown; all but the last postnuclear whorl bright chestnut-brown; the last whorl almost blackish brown. The interior of the aperture bluish white, the expanded peristome and columella blackish brown. The postnuclear whorls are covered with a thin periostracum, showing retractively slanting hydrophanous bands, which are of varying shapes, sometimes regular zones, sometimes fulgurations, even in the same individual. These bands extend from the summit of the whorl to the umbilical chink. Nuclear whorls 3, the first well rounded and marked by lines of growth only, the succeeding turns marked by almost threadlike incremental lines. These also show the hydrophanous marks referred to under the postnuclear sculpture. The postnuclear whorls are appressed at the summit, moderately well rounded, and marked by threadlike lines of growth, which vary much in strength and spacing, and also by numerous, closely spaced, fine, incised spiral lines and the usual criss-cross sculpture, which is present on both spire and base. The suture is moderately impressed. The periphery is obsoletely angulated. The base is comparatively short, inflated, and well rounded. The aperture is broadly oval. The outer lip is strongly expanded and reflected. The columella is also broadly expanded and reflected, forming a narrow umbilicus. The parietal wall is covered by a rather thick callus.

This subspecies is the largest of the *Cochlostyla* (*Chrysallis*) *aspersa* group. In size it suggests *Cochlostyla* (*Chrysallis*) *rollei*, from which it can at once be distinguished by its dark apex.

The type locality is on the west side of Mindoro.

The type (U.S.N.M. no. 313702), collected by Pedro de Mesa at Calamintao, Mamburao, Mindoro, has 5.5 whorls and measures: Length, 64.4 mm; greater diameter, 34.4 mm; lesser diameter, 31.6 mm.

Fourteen topotypes (U.S.N.M. no. 313649) from the same source yield the following measurements:

Number of whorls	Length	Greater diameter	Lesser diameter
	Mm	*Mm*	*Mm*
5.4	67.5	36.5	32.3
5.7	57.2	31.0	27.5
6.1	65.1	32.6	29.5
5.3	70.2	38.3	33.2
5.9	57.8	30.7	27.3
5.1	55.4	30.1	27.3
5.9	56.2	30.0	28.4
5.9	71.4	35.4	29.3
5.5	64.5	33.3	30.7
4.9	58.6	34.4	29.8
6.0	62.6	33.0	28.6
5.8	63.7	34.8	29.0
5.7	62.2	32.5	30.8
5.5	60.1	34.6	30.0
5.6 [1]	[1] 62.3	[1] 33.3	[1] 29.5
6.1 [2]	[2] 71.4	[2] 38.3	[2] 33.2
4.9 [3]	[3] 55.4	[3] 30.0	[3] 27.3

[1] Average. Greatest. [3] Least.

COCHLOSTYLA (CHRYSALLIS) ASPERSA ASPERSA (Grateloup)

Plate 112, Figures 1, 3

1840. *Bulimus aspersa* Grateloup, Actes Soc. Linn. Bordeaux, vol. 11, p. 164.

1840. *Bulimus aspersus* Grateloup, Mémoire sur plusieurs espèces de coquilles nouvelle ou peu connues de mollusques . . . , pp. 35–36, pl. 4, fig. 3.

1841. *Bulinus mindoroensis* BRODERIP, Proc. Zool. Soc. London, 1840, pp. 84–86; in part.
1842. *Bulimus mindoroensis* REEVE, Conchologia systematica . . . , vol. 2, p. 81, pl. 173, fig. 5.
1842. *Bulimus aspersus* PFEIFFER, Symbolae, vol. 2, p. 48.
1848. *Bulimus mindoroensis* PFEIFFER, Monographia heliceorum viventium, vol. 2, pp. 76–77; in part.
1851. *Bulimus mindoroensis* DESHAYES, Férussac's Histoire naturelle . . . mollusques . . . , vol. 2, pp. 15–16 (in part), pl. 149, figs. 1, 2.
1855. *Bulimus mindoroensis* PFEIFFER, Martini-Chemnitz Conchylien Cabinet, ed. 2, vol. 1, Abt. 13, Theil 1, pp. 202–203; in part.
1856. *Bulimus aspersus* PFEIFFER, Malakozool. Blätter, vol. 2, p. 150.
1859. *Bulimus mindoroensis* PFEIFFER, Monographia heliceorum viventium, vol. 4, pp. 387–388; in part.
1860. *Chrysallis adspersa* MARTENS, Albers, Die Heliceen, ed. 2, p. 179.
1876. *Bulimus aspersus* PFEIFFER, Monographia heliceorum viventium, vol. 7, p. 49.
1877. *Cochlostyla aspersa* SEMPER, Reisen im Archipel der Philippinen, pt. 2, vol. 3, p. 222.
1892. *Cochlostyla mindoroensis* PILSBRY, Man. Conch., ser. 2, vol. 8, pp. 52–53 (in part), pl. 14, fig. 69.
1895. *Helicostyla mindoroensis* PILSBRY, Man. Conch., ser. 2, vol. 9, p. 231; in part.
1896. *Chrysallis mindoroensis* ELERA, Catalogo sistematico de toda la fauna de Filipinas, vol. 3, pp. 611–612; in part.
1897. *Cochlostyla aspersa* HIDALGO, Journ. Conchyl., vol. 44, pp. 247, 248, 263.
1901. *Cochlostyla mindoroensis* HIDALGO, Obras malacologicas, pp. 548–550 (in part), pl. 97, fig. 3.
1914. *Cochlostyla mindoroensis* MÖLLENDORFF, KOBELT, and WINTER, Semper's Reisen im Archipel der Philippinen, vol. 10, pp. 336–338; in part.
1932. *Cochlostyla* (*Chrysallis*) *aspersa aspersa* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 341.

Shell ovate. The nuclear whorls are dark chocolate-brown; the first postnuclear turn is buff; the rest are chocolate-brown, becoming darkest on the last part of the last turn. The postnuclear turns are covered with a moderately thick periostracum, which is blotched or streaked with buff or orange-buff, the base being darker than the posterior portion of the last whorl. The base is rather short, somewhat inflated, and strongly rounded. Aperture broadly oval. The peristome is expanded and reflected, particularly at the insertion of the columella, where it is reflected over the umbilicus, which it more than half covers. The parietal wall is covered by a rather thick callus.

This race differs from *Cochlostyla* (*Chrysallis*) *aspersa mindoroensis* in being more ovate, more inflated and chubby. It differs from *Cochlostyla* (*Chrysallis*) *aspersa lunai* in being in every way smaller.

The specimen described and figured (U.S.N.M. no. 313740a) is one collected by the Menage Expedition, as stated before, probably on the western shore of Lake Naujan. It seems to satisfy most closely the figure given of this species by Grateloup (see pl. 112, fig. 3, which is a copy of it). This shell has 5.5 whorls and measures: Length, 57.8 mm; greater diameter, 31.8 mm; lesser diameter, 26.7 mm.

A series of 40 specimens, collected by Mr. de Mesa at Ariod, Naujan, Mindoro, furnishes the following data:

U.S.N.M. no.	Number of whorls	Length	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
313703	5. 8	61. 0	33. 5	27. 3
313703	5. 0	60. 3	31. 4	26. 8
313703	6. 0	54. 2	32. 1	28. 0
313703	6. 1	56. 1	32. 2	26. 6
313703	5. 9	66. 3	35. 4	29. 8
313703	5. 2	59. 8	33. 3	27. 0
313703	5. 4	54. 0	31. 6	26. 9
313703	5. 8	65. 4	35. 9	29. 3
313703	5. 7	61. 0	33. 8	28. 1
313703	5. 5	60. 5	33. 8	28. 0
313703	5. 4	58. 2	35. 7	29. 6
313703	5. 6	59. 3	33. 2	28. 1
313703	5. 7	60. 3	32. 2	27. 1
313703	5. 4	57. 8	33. 5	28. 6
313703	5. 4	58. 0	33. 7	29. 5
313703	5. 6	56. 4	31. 8	27. 6
313703	5. 5	61. 4	35. 3	30. 1
313703	5. 5	60. 6	32. 7	27. 0
313703	6. 0	60. 5	35. 0	29. 8
313703	6. 0	67. 9	37. 8	31. 2
313703	5. 6	56. 3	33. 8	28. 0
313658	5. 2	67. 3	32. 2	27. 4
313658	5. 0	57. 8	28. 9	25. 2
313658	5. 1	55. 9	30. 2	26. 5
313658	5. 2	64. 8	32. 5	28. 4
313658	5. 3	64. 8	32. 8	29. 0
313658	5. 0	60. 1	30. 6	27. 8
313658	5. 2	65. 7	35. 2	30. 5
313658	5. 6	64. 1	30. 2	27. 5
313658	5. 1	61. 8	31. 9	28. 0
313658	5. 0	61. 0	30. 6	28. 0
313658	4. 9	58. 1	31. 0	27. 7
313658	5. 1	58. 6	39. 6	36. 6
255868	4. 9	53. 7	29. 8	26. 2
255868	5. 0	58. 6	32. 6	29. 3
255868	5. 1	54. 9	31. 4	26. 9
313704	5. 2	61. 6	32. 0	28. 6
313704	5. 1	63. 0	31. 5	29. 2
313704	4. 9	60. 0	30. 9	27. 7
313704	5. 1	57. 9	31. 7	28. 0
Average	5. 37	60. 1	32. 8	28. 3
Greatest	6. 1	67. 9	37. 8	36. 6
Least	4. 9	53. 7	28. 9	25. 2

COCHLOSTYLA (CHRYSALLIS) ASPERSA JUANI Bartsch

PLATE 112, FIGURE 2

1932. *Cochlostyla* (*Chrysallis*) *aspersa juani* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 342.

1933. *Helicostyla* (*Chrysallis*) *mindoroensis* CLENCH and ARCHER, Papers Michigan Acad. Sci., Arts, Letters, vol. 17, p. 544; in part.

The shell is quite small, ovate. The first 1.5 nuclear whorls are very pale brown, the rest darker brown, and this color gradually deepens in intensity until on the last whorl it is bright chestnut-brown. The later nuclear whorls and the postnuclear whorls show hydrophanous axial bands of various widths and shape, sometimes mere lines and varying from this to fulgurations. These bands are present on both spire and base. They are of an olivaceous-buff tint. The aperture is pale blue within. The peristome is dark blackish brown, which is also the color of the outer edge of the inner lip, the inner portion of the columella being the same color as the interior of the aperture. Nuclear whorls 2.5, forming a moderately elevated spire, all but the last marked by fine lines of growth, the latter marked by the crisscross sculpture of the postnuclear turns. The postnuclear turns are appressed at the summit, moderately rounded, marked by rather irregular, variable incremental lines and microscopic, closely spaced, spiral striations, as well as exceedingly fine crisscross sculpture on both spire and base. The suture is moderately impressed. The periphery is feebly angulated. The base is short, inflated, and well rounded. The aperture is broadly oval. The outer lip is expanded and reflected. The columella is moderately expanded and reflected to form a narrow umbilicus.

This race is the smallest of the short-based forms, a fact that readily distinguishes it from the other races.

The type (U.S.N.M. no. 313708), collected by Pedro de Mesa at Camorong in the Municipality of Abra de Ilog, northern Mindoro, has 6.2 whorls and measures: Length, 47.3 mm; greater diameter, 26.4 mm; lesser diameter, 23 mm.

Six topotypes (U.S.N.M. no. 313709) yield the following additional measurements:

Number of whorls	Length	Greater diameter	Lesser diameter
	Mm	*Mm*	*Mm*
5.9	48. 0	27. 2	23. 4
5.9	46. 6	25. 8	22. 3
6.0	47. 0	26. 0	21. 9
6.0	43. 4	25. 6	21. 2
6.0	46. 3	26. 2	21. 8
5.6	47. 5	27. 4	23. 8

COCHLOSTYLA (CHRYSALLIS) ASPERSA MINDOROENSIS (Broderip)

Plate 112, Figures 6, 8

1841. *Bulinus mindoroensis* Broderip, Proc. Zool. Soc. London, 1840, pp. 84–86; in part.
1842. *Bulinus mindoroensis* Reeve, Conchologia systematica . . ., vol. 2, pl. 57, figs. 4, 5.
1842. *Bulimus mindoroensis* Pfeiffer, Symbolae, vol. 2, p. 48.
1848. *Bulimus mindoroensis* Pfeiffer, Monographia heliceorum viventium, vol. 2, pp. 76–77; in part.
1849. *Bulimus mindoroensis* Reeve, Conchologia iconica, pl. 4, fig. 15.
1850. *Chrysallis mindoroensis* Albers, Die Heliceen, ed. 1, p. 141.
1851. *Bulimus mindoroensis* Deshayes, Férussac's Histoire naturelle . . . mollusques . . ., vol. 2, pp. 15–16 (in part), pl. 149, figs. 6, 7.
1852. *Chrysallis mindoroensis* Mörch, Catalogus conchyliorum, quae reliquit Alphonso d'Aguirra y Gadea, Comes de Yoldi, vol. 1, p. 30.
1853. *Bulimus mindoroensis* Pfeiffer, Monographia heliceorum viventium, vol. 3, pp. 325–326; in part.
1855. *Bulimus mindoroensis* Pfeiffer, Martini-Chemnitz Conchylien Cabinet, ed. 2, vol. 1, Abt. 13, Theil 1, pp. 202–203; in part.
1855. *Cochlostyla mindoroensis* H. and A. Adams, The genera of recent Mollusca, vol. 2, p. 143.
1856. *Bulimus mindoroensis* Pfeiffer, Malakozool. Blätter, vol. 2, p. 150.
1859. *Bulimus mindoroensis* Pfeiffer, Monographia heliceorum viventium, vol. 4, pp. 387–388; in part.
1860. *Chrysallis mindoroensis* Martens, Albers, Die Heliceen, ed. 2, p. 179.
1868. *Bulimus mindoroensis* Pfeiffer, Monographia heliceorum viventium, vol. 6, p. 34; in part.
1876. *Bulimus mindoroensis* Pfeiffer, Monographia heliceorum viventium, vol. 7, p. 49; in part.
1877. *Cochlostyla mindoroensis* Semper, Reisen im Archipel der Philippinen, pt. 2, vol. 3, p. 222.
1887. *Cochlostyla mindoroensis* Hidalgo, Journ. Conchyl., vol. 35, pp. 173–174; in part.
1892. *Cochlostyla mindoroensis* Pilsbry, Man. Conch., ser. 2, vol. 8, pp. 52–53 (in part), pl. 14, fig. 71.
1895. *Helicostyla mindoroensis* Pilsbry, Man. Conch., ser. 2, vol. 9, p. 231; in part.
1896. *Chrysallis mindoroensis* Elera, Catalogo sistematico de toda la fauna de Filipinas, vol. 3, pp. 611–612; in part.
1897. *Cochlostyla mindoroensis* Hidalgo, Journ. Conchyl., vol. 44, pp. 247, 248, 263, 296, 298, 325, 331, 341, 350, 352.
1898. *Cochlostyla mindoroensis* Möllendorff, Abh. Naturf. Ges. Gorlitz, vol. 22, p. 146; in part.
1901. *Cochlostyla mindoroensis* Hidalgo, Obras malacologicas, pp. 548–550 (in part), pl. 97, fig. 4.
1914. *Cochlostyla mindoroensis* Möllendorff, Kobelt, and Winter, Semper's Reisen im Archipel der Philippinen, vol. 10, pp. 336–338 (in part), pl. 175, figs. 4–6.
1932. *Cochlostyla* (*Chrysallis*) *aspersa mindoroensis* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 342.

Shell elongate-ovate. The nuclear whorls and the first half of the postnuclear turns are chocolate-brown; the succeeding turn is pale chestnut-brown; the last whorl chestnut-brown. The shell is covered with a moderately thick periostracum, which is streaked, banded, and sometimes fulgurated with retractively slanting axial streaks of buff or orange-buff, alternating with brown and almost blackish-brown bands, the darkest coloration always being on the last whorl and the base of the last whorl being always darker than the posterior portion of it. The aperture is decidedly bluish within, this coloration extending to the inner edge of the periostracum, the outer expanded peristome being dark, almost black, with an azurite reflection. The inner edge of the columella is like the interior of the aperture, possibly a trifle darker, while the outer portion continues the color of the peristome. Nuclear whorls 3; the first smooth and the rest marked like the postnuclear turns, the space between grading into these sculptures. The postnuclear whorls are appressed at the summit, moderately well rounded, and marked by retractively slanting lines of growth, which are somewhat irregular in width and spacing. In addition the whorls are marked by the characteristic crisscross sculpture described for the species, which is present on base and spire. The aperture is broadly oval; peristome is broadly expanded and reflected, particularly so at the insertion of the columella where it almost covers the umbilicus, leaving only a very narrow chink. The parietal wall is covered by a moderately thick callus.

This subspecies is most nearly related to the typical form but is slenderer.

Number of whorls	Length	Greater diameter	Lesser diameter
	Mm	*Mm*	*Mm*
6.0	58.4	29.1	23.9
6.0	63.3	33.1	27.6
5.9	54.1	29.6	24.9
6.1	55.1	26.7	22.6
6.1	59.3	29.0	24.5
5.5	49.6	27.8	24.6
6.0	54.1	28.1	24.7
5.5	55.4	31.1	26.6
5.6	57.5	27.8	23.1
6.0	56.8	30.8	26.3
5.8	60.8	32.8	28.0
5.5	49.0	28.0	23.7
5.5	56.8	32.3	26.8
5.6	54.9	27.3	23.7
5.8	60.4	33.2	28.1
5.6	60.9	31.6	26.0
5.7	52.8	30.1	26.0
5.9	59.7	29.5	26.3
5.78[1]	[1] 56.6	[1] 29.88	[1] 25.4
6.0[2]	[2] 63.3	[2] 33.2	[2] 28.1
5.5[3]	[3] 49.0	[3] 26.7	[3] 22.6

[1] Average.

[2] Greatest.

[3] Least.

The specimen described and figured well represents the form depicted by Reeve. I am adding a copy of Reeve's illustration (see figure 15, Conchologia Iconica) for comparison. This specimen was collected by von Möllendorff and bears only the label "Mindoro." It has 6 whorls and measures: Length, 63.3 mm; greater diameter, 32.4 mm; lesser diameter, 28.5 mm.

It probably came from the region of Puerto Galera.

Eighteen specimens (U.S.N.M. no. 313705) received from Pedro de Mesa were collected by him at Dulangan, Puerto Galera, and yield the measurements given in the foregoing table.

COCHLOSTYLA (CHRYSALLIS) ASPERSA MELANOGASTER (Mörch)

Plate 112, Figure 4

1841. *Bulinus mindoroensis* Broderip, Proc. Zool. Soc. London, 1840, pp. 84–86; in part.

1851. *Bulimus mindoroensis* Deshayes, Férussac's Histoire naturelle . . . mollusques . . ., vol. 2, pp. 15–16 (in part), p.l 149, fig. 9(?).

1852. *Chrysallis melanogaster* Mörch, Catalogus conchyliorum, quae reliquit Alphonso d'Aguirra y Gadea, Comes de Yoldi, vol. 1, p. 30.

1853. *Bulimus mindoroensis* Pfeiffer, Monographia heliceorum viventium, vol. 3, pp. 325–326; in part.

1855. *Bulimus mindoroensis* Pfeiffer, Martini-Chemnitz Conchylien Cabinet, ed. 2, vol. 1, Abt. 13, Theil 1, pp. 202–203 (in part), pl. 57, figs. 4, 5.

1859. *Bulimus mindoroensis* Pfeiffer, Monographia heliceorum viventium, vol. 4, pp. 387–388; in part.

1868. *Bulimus mindoroensis* Pfeiffer, Monographia heliceorum viventium, vol. 6, p. 34; in part.

1876. *Bulimus mindoroensis* Pfeiffer, Monographia heliceorum viventium, vol. 7, p. 49; in part.

1892. *Cochlostyla mindoroensis* Pilsbry, Man. Conch., ser. 2, vol. 8, pp. 52–53 (in part), pl. 14, fig. 68.

1895. *Helicostyla mindoroensis* Pilsbry, Man. Conch., ser. 2, vol. 9, p. 231; in part.

1896. *Chrysallis mindoroensis* Elera, Catalogo sistematico de toda la fauna de Filipinas, vol. 3, pp. 611–612; in part.

1897. *Cochlostyla melanogaster* Hidalgo, Journ. Conchyl., vol. 44, pp. 296, 298.

1898. *Cochlostyla mindoroensis* Möllendorff, Abh. Naturf. Ges. Görlitz, vol. 22, p. 146; in part.

1901. *Cochlostyla mindoroensis* Hidalgo, Obras malacologicas, pp. 548–550; in part.

1914. *Cochlostyla mindoroensis melanogaster* Möllendorff, Kobelt, and Winter, Semper's Reisen im Archipel der Philippinen, vol. 10, pp. 336–338; in part.

1932. *Cochlostyla* (*Chrysallis*) *aspersa melanogaster* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 342.

1933. *Helicostyla* (*Chrysallis*) *mindoroensis* Clench and Archer, Papers Michigan Acad. Sci., Arts, Letters, vol. 17, p. 544; in part.

Shell rather small, slender, elongate-ovate. The nuclear whorls are dark chocolate-brown, the succeeding turn bright chestnut-brown, the last whorl blackish brown. A moderately strong periostracum covers the surface of the shell, and this is streaked with retractively slanting streaks, blotches, spots, and sometimes fulgurations of buff or orange-buff. The base of the last whorl is always darker than the posterior half of the turn. The aperture is white with a bluish tint within. The peristome is very dark brown, almost black, with a bluish reflection, the inner edge of the columella, particularly at its insertion, tending to the same color as that of the aperture. The parietal wall is covered by a dark callus. Nuclear whorls almost 3; the first smooth, the rest gradually acquiring the sculpture of the postnuclear turns. The postnuclear whorls are moderately rounded, appressed at the summit, and marked by retractively slanting lines of growth and obsolete spiral striations and also by rather coarse microscopic crisscross sculpture. The aperture is broadly oval; the peristome is very broadly expanded and reflected.

Number of whorls	Length	Greater diameter	Lesser diameter
	Mm	*Mm*	*Mm*
5.6	51. 3	25. 8	21. 8
5.7	54. 4	27. 8	22. 5
5.6	48. 2	27. 8	23. 1
5.6	48. 6	27. 3	22. 4
5.6	52. 3	27. 7	23. 7
5.7	50. 6	27. 4	22. 7
5.7	51. 1	27. 3	22. 6
5.8	48. 3	26. 4	22. 2
5.8	48. 0	27. 8	22. 4
5.8	53. 7	26. 5	22. 0
5.6	51. 7	29. 4	24. 4
5.8	51. 9	28. 4	23. 4
5.7	52. 3	30. 0	24. 3
5.6	49. 4	25. 9	21. 8
5.9	53. 8	28. 3	23. 4
5.6	47. 3	26. 0	21. 6
5.8	50. 3	25. 6	21. 4
5.7	50. 8	28. 0	23. 1
5.8	51. 3	26. 7	22. 7
5.8	49. 4	27. 8	23. 9
5.6	46. 7	26. 8	22. 8
5.2	54. 5	27. 0	23. 3
5.0	49. 1	26. 3	22. 4
5.0	48. 8	26. 6	23. 5
5.0	54. 0	27. 5	24. 2
5.2	50. 8	27. 5	24. 1
4.7	51. 8	27. 4	24. 2
5.0	48. 3	25. 5	22. 4
5.5	54. 5	25. 3	23. 1
4.5	46. 0	26. 1	22. 5
5.0	52. 8	26. 4	22. 5
5.0	53. 7	27. 8	24. 1
4.9	45. 2	25. 7	22. 7
5.2	54. 3	26. 8	22. 8
5.4 [1]	[1] 50. 74	[1] 27. 07	[1] 22. 94
5.9 [2]	[2] 54. 5	[2] 30. 0	[2] 24. 4
4.5 [3]	[3] 45. 2	[3] 25. 3	[3] 21. 4

[1] Average. [2] Greatest. [3] Least.

The specimen described and figured (U.S.N.M. no. 313657a) was collected by Pedro de Mesa on Mount Sapol near Calapan, Mindoro. It has 5.8 whorls and measures: Length, 49.3 mm; greater diameter, 26 mm; lesser diameter, 22.1 mm. This corresponds well with Pfeiffer's figures 4 and 5 of plate 57, Martini-Chemnitz, which Mörch took as the basis for his name and which I am reproducing here.

An additional series of specimens (U.S.N.M. no. 313657), from the same source, yields the data given in the foregoing table.

COCHLOSTYLA (CHRYSALLIS) ASPERSA WAGNERI (Grateloup)

Plate 113, Figures 4, 7

1840. *Bulimus wagneri* Grateloup, Actes Soc. Linn. Bordeaux, vol. 11, p. 164.
1840. *Bulimus aspersus* var. *wagneri* Grateloup, Mémoire sur plusieurs espèces de coquilles nouvelles ou peu connues de mollusques . . ., p. 35, pl. 2, fig. 8.
1841. *Bulinus mindoroensis* Broderip, Proc. Zool. Soc. London, 1840, pp. 84–86; in part.
1842. *Bulimus mindoroensis* Pfeiffer, Symbolae, vol. 2, p. 48.
1848. *Bulimus mindoroensis* Pfeiffer, Monographia heliceorum viventium, vol. 2, pp. 76–77; in part.
1852. *Chrysallis wagneri* Mörch, Catalogus conchyliorum, quae reliquit Alphonso d'Aguirra y Gadea, Comes de Yoldi, vol. 1, p. 30.
1853. *Bulimus mindoroensis* Pfeiffer, Monographia heliceorum viventium, vol. 3, pp. 325–326; in part.
1859. *Bulimus mindoroensis* Pfeiffer, Monographia heliceorum viventium, vol. 4, pp. 387–388; in part.
1868. *Bulimus mindoroensis* Pfeiffer, Monographia heliceorum viventium, vol. 6, p. 34; in part.
1876. *Bulimus mindoroensis* Pfeiffer, Monographia heliceorum viventium, vol. 7, p. 49; in part.
1887. *Cochlostyla mindoroensis* Hidalgo, Journ. Conchyl., vol. 35, p. 174; in part.
1892. *Cochlostyla mindoroensis* Pilsbry, Man. Conch., ser. 2, vol. 8, pp. 52–53; in part.
1895. *Helicostyla mindoroensis* Pilsbry, Man. Conch., ser. 2, vol. 9, p. 231; in part.
1896. *Chrysallis mindoroensis* Elera, Catalogo sistematico de toda la fauna de Filipinas, vol. 3, pp. 611–612; in part.
1897. *Cochlostyla wagneri* Hidalgo, Journ. Conchyl., vol. 44, pp. 248, 298, 325.
1898. *Cochlostyla mindoroensis* Möllendorff, Abh. Naturf. Ges. Görlitz, vol. 22, p. 146; in part.
1901. *Cochlostyla mindoroensis* Hidalgo, Obras malacologicas, pp. 548–550; in part.
1914. *Cochlostyla mindoroensis* Möllendorff, Kobelt, and Winter, Semper's Reisen im Archipel der Philippinen, vol. 10, pp. 336–338; in part.
1932. *Cochlostyla* (*Chrysallis*) *aspersa wagneri* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 342.

Shell elongate-ovate. The base of the last whorl is rather short and well rounded. The early whorls are dull bluish chocolate-brown, the middle one buff with a brownish tint and the last one chestnut-brown. The postnuclear whorls are marked by retractively slanting bands, blotches, spots, or fulgurations of yellowish buff, which extend over both spire and base. The basal portion of the last whorl is slightly darker than the space posterior to it. The interior of the aperture is pale bluish; the broadly expanded peristome is chocolate-brown at the edge with a very strong iridescent bright bluish tinge on the inner half. There is a wide bluish white triangular spot on the inner edge of the columella at its insertion. Nuclear whorls 3; the first well rounded, smooth, the rest marked by fine axial threads, which gradually develop into the postnuclear sculpture. The postnuclear whorls are appressed at the summit, moderately well rounded, and marked by irregular, retractively slanting lines of growth, obsolete spiral striations, and the usual crisscross sculpture both on spire and base. The aperture is broadly oval. The peristome is strongly expanded and reflected both on the outer lip and columella. In the latter place it almost covers the umbilicus. The parietal wall is covered by a moderately thick callus.

Number of whorls	Length	Greater diameter	Lesser diameter
	Mm	*Mm*	*Mm*
5.6	54. 8	28. 9	23. 4
6.0	58. 3	31. 6	25. 7
5.8	54. 4	29. 6	25. 0
5.5	49. 7	27. 0	22. 2
5.7	53. 7	28. 8	23. 5
5.8	57. 9	31. 4	25. 3
5.7	59. 7	30. 4	24. 8
5.6	58. 0	30. 6	23. 8
6.0	55. 7	26. 4	22. 3
5.9	55. 8	28. 0	22. 9
5.6	54. 2	29. 7	24. 7
6.0	57. 8	32. 0	25. 5
5.9	60. 6	31. 3	23. 5
5.9	59. 2	30. 3	25. 8
6.1	61. 2	30. 9	23. 6
5.9	56. 4	28. 3	23. 1
5.9	57. 9	28. 6	24. 4
5.8	54. 4	27. 9	23. 8
6.0	60. 3	29. 1	25. 0
6.0	60. 8	27. 1	23. 4
6.0	58. 1	27. 4	22. 8
5.6	51. 3	28. 8	23. 9
5.4	56. 5	29. 1	25. 6
5.6	50. 8	28. 1	24. 0
5.8	54. 6	28. 6	23. 4
5.6	58. 9	29. 7	24. 7
5.5	55. 0	27. 4	23. 2
5.8	57. 2	30. 3	25. 7
5.6	59. 3	30. 0	25. 3
5.6	59. 1	29. 3	25. 0
5.77 [1]	[1] 56. 72	[1] 29. 2	[1] 24. 17
6.1 [2]	[2] 61. 2	[2] 32. 0	[2] 25. 8
5.4 [3]	[3] 49. 7	[3] 26. 4	[3] 22. 2

[1] Average. [2] Greatest. [3] Least.

Grateloup's figure shows a badly worn and decorticated specimen, which I can match with some material from the Lake Naujan region. The race about this lake has the short, rounded base and is smaller than typical *aspersa* to the north of this region. I am, therefore, reserving Grateloup's name for this race.

Thirty specimens (U.S.N.M. no. 313711), collected by Worcester and Bourns on the Menage Expedition about Lake Naujan, yield the data given in the foregoing table.

The specimen described and figured (U.S.N.M. no. 313710) was collected by Worcester and Bourns on the Menage Expedition. It has 5.9 whorls and measures: Length, 59.9 mm; greater diameter, 30 mm; lesser diameter, 24.5 mm.

COCHLOSTYLA (CHRYSALLIS) ASPERSA EDGARI Bartsch

PLATE 113, FIGURE 6

1932. *Cochlostyla* (*Chrysallis*) *aspersa edgari* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 342.

Shell elongate-ovate. The base of the last whorl is considerably protracted and gently rounded. Early whorls are chocolate-brown with a purplish tinge; the middle whorl is buff, and the last chestnut-brown. The whorls are marked by retractively slanting bands of yellowish buff, which may be fulgurated, broken, or more or less complete, though alternating with zones of the ground color of the shell. Interior of the aperture pale bluish; peristome with a chocolate-brown outer edge, the inner portion of the peristome fading into the color of the aperture, both on the outer lip and the columella. Nuclear whorls 3, the first smooth, the rest grading into the sculpture of the postnuclear whorls, which consists of irregular, retractively curved, incremental lines. The usual crisscross microscopic sculpture is well pronounced on both spire and base. The postnuclear whorls are appressed at the summit and moderately well rounded. The periphery is also rounded and the protracted base gently so. Aperture broadly oval; outer lip broadly expanded and reflected, the inner lip likewise expanded and reflected, particularly at its insertion, where it almost covers the umbilicus. The parietal wall is covered by a rather stout callus.

The type (U.S.N.M. no. 313712) was collected by Col. Edgar A. Mearns on the Mount Halcon Expedition. It has 6 whorls and measures: Length, 66.2 mm, greater diameter, 32 mm; lesser diameter, 28.2 mm.

Eight topotypes (U.S.N.M. no. 255799) yield the following additional measurements:

Number of whorls	Length	Greater diameter	Lesser diameter
	Mm	*Mm*	*Mm*
6. 1	63. 0	31. 1	26. 5
6. 5	63. 6	30. 0	25. 9
5. 6	60. 9	30. 3	25. 9
6. 1	64. 4	31. 4	27. 7
5. 8	63. 2	32. 8	27. 8
6. 1	60. 1	29. 8	25. 3
6. 3	61. 9	31. 2	26. 8
6. 3	59. 2	30. 0	26. 0

Another specimen in our collection (U.S.N.M. no. 255798) is labeled "Mindoro of Luzun", also collected by Colonel Mearns, a locality that I have been unable to locate, but also on Mount Halcon. This specimen has 6.3 whorls and measures: Length, 62 mm; greater diameter, 31.5 mm.

Another specimen without specific locality comes from the Cuming collection. This is the largest of the races belonging to the group with the protracted base.

COCHLOSTYLA (CHRYSALLIS) ASPERSA BINUANGANA Bartsch

Plate 112, Figure 5

1932. *Cochlostyla* (*Chrysallis*) *aspersa binuangana* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 342.

1933. *Helicostyla* (*Chrysallis*) *mindoroensis furva* Clench and Archer, Papers Michigan Acad. Sci., Arts, Letters, vol. 17, p. 546, pl. 58, fig. 3.

Shell elongate-ovate; the first postnuclear whorls are smoky buff, the remaining chocolate-color, the last turn being blackish chocolate-brown. The interior of the aperture is pale blue; the peristome and outer edge of the columella are blackish brown. The inner edge of the columella is pale blue. The entire shell, except the first nuclear whorl, is covered by a thin periostracum, crossed by hydrophanous buff-colored bands, which cover the last whorl for the major part. These hydrophanous markings are very irregular, sometimes almost axial, sometimes fulgurated, sometimes blotched and spotted, and they extend over both spire and base. There is an indication of a dislocation of the bands at the periphery of the last turn. Nuclear whorls 2.8; the first smooth, the next marked by incremental lines, which on the last turn assume almost the strength of threads. The postnuclear whorls are well rounded, appressed at the summit, and marked by irregular threadlike incremental lines, which are retractively slanting. The whorls are also marked by microscopic, closely spaced, spiral striations, and the usual crisscross sculpture. The periphery is obsoletely angulated. The base is rather long, somewhat inflated, well rounded. The aperture is broadly oval; the outer lip is expanded and reflected. The columella is rather narrow, also reflected, forming a narrow umbilicus. The parietal wall is covered by a moderately thick callus.

The type (U.S.N.M. no. 313713), collected by Pedro de Mesa at Binuangan, Principality of Paluan, Mindoro, has 6 whorls and measures: Length, 49 mm; greater diameter, 26 mm; lesser diameter, 22 mm.

A series of topotypes, also collected by Mr. de Mesa, yields the following data:

U.S.N.M. no.	Number of whorls	Length	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
313647	6.3	51.7	26.5	22.7
313647	6.0	47.7	25.5	21.7
313647	6.1	46.2	23.7	21.0
313647	6.0	49.4	27.9	22.9
313647	6.1	48.8	24.8	22.1
313647	6.1	48.7	26.1	22.2
313647	6.1	51.4	26.0	22.3
313647	6.2	50.0	25.1	21.5
313647	6.0	47.4	22.7	20.6
313647	6.2	49.5	25.5	21.8
313647	6.2	49.6	28.3	22.6
313647	6.1	48.6	26.4	22.3
313647	6.1	50.5	25.7	21.4
313647	5.8	42.1	23.3	21.1
313647	6.0	47.5	25.5	22.0
313647	6.2	50.8	25.8	22.0
313647	6.5	52.0	25.5	21.5
313647	6.6	57.5	26.2	21.4
313647	6.5	56.0	26.8	22.9
313647	6.5	54.8	25.8	21.4
313647	6.4	57.3	25.9	22.2
313647	6.1	50.0	28.2	23.7
313647	6.2	50.5	26.1	21.9
313647	5.9	45.0	24.2	21.4
313647	5.9	44.9	23.3	20.2
313654	6.1	50.1	28.3	23.5
313654	5.9	48.7	24.5	21.1
313654	6.2	52.8	26.0	22.1
313654	6.0	50.5	27.1	23.7
313654	6.2	53.0	28.4	23.5
313654	6.1	53.9	29.4	24.2
313654	6.0	50.5	24.4	21.4
313654	6.2	52.8	28.5	22.7
313654	6.0	48.9	24.5	21.0
313654	6.3	51.4	27.8	23.2
313654	6.3	52.6	25.1	21.5
313654	6.0	49.5	25.8	21.5
313654	6.0	47.0	25.4	21.9
Average	6.14	50.2	25.92	22.05
Greatest	6.6	57.5	29.4	24.2
Least	5.8	42.1	22.7	20.2

U.S.N.M. no. 313648 contains six specimens from Pula, Principality of Paluan, Mindoro, which I am provisionally referring here, also collected by Mr. de Mesa.

This is a very dark-colored ovate form, which suggests *Cochlostyla* (*Chrysallis*) *aspersa melanogaster* but lacks the dark basal coloration.

COCHLOSTYLA (CHRYSALLIS) ASPERSA ILOGANA Bartsch

Plate 113, Figure 8

1932. *Cochlostyla* (*Chrysallis*) *aspersa ilogana* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 342.

1933. *Helicostyla* (*Chrysallis*) *mindoroensis parallaxis* Clench and Archer, Papers Michigan Acad. Sci., Arts, Letters, vol. 17, p. 550; in part.

Shell very elongate and regularly ovate, all but the last whorl pale chestnut-brown, that one very dark brown, almost black. The shell is covered with a rather strong periostracum, which is axially retractively streaked with zones of dull buff, these zones varying materially in width and permitting the ground color of the shell to appear in the interspaces. The light zones are not at all regular but vary from straight bands to fulgurations. The base is usually slightly darker than the posterior half of the last whorl, and here the bands frequently assume an orange-buff tinge. The aperture is pale blue within; the broadly expanded peristome is almost black. There is a bluish triangle at the inner edge of the insertion of the columella. Nuclear whorls 2.8, the first smooth, the rest gradually assuming the postnuclear sculpture. The postnuclear whorls are slightly shouldered at the summit, almost flattened, the last one is feebly angulated at the periphery and has the base strongly protracted. They are marked by retractively curved, almost flattened, threadlike lines of growth, which extend on the last whorl to the umbilical chink. In addition they are marked by obsolete spiral striations and the usual crisscross microscopic sculpture. The aperture is elongate-oval; the peristome is broadly expanded and reflected, that of the inner lip almost covering the umbilicus. The parietal wall is covered by a rather strong callus.

The type (U.S.N.M. no. 313706) was collected by Pedro de Mesa at Camorong, Abra de Ilog, Mindoro. It has 6.8 whorls and measures: Length, 66.3 mm; greater diameter, 31.7 mm; lesser diameter, 25.6 mm.

Thirty-eight topotypes (U.S.N.M. nos. 313707, 313659, and 313662) yield the additional information shown on the following page.

U.S.N.M. no.	Number of whorls	Length	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
313707	6. 7	64. 8	32. 5	26. 8
313707	6. 7	63. 7	33. 4	28. 2
313707	6. 6	60. 2	29. 3	26. 2
313707	6. 4	60. 1	29. 3	25. 6
313707	6. 4	58. 9	31. 3	26. 5
313707	6. 6	58. 3	30. 3	24. 5
313707	6. 0	59. 9	29. 3	25. 3
313707	6. 4	60. 3	32. 4	26. 9
313707	6. 7	66. 1	31. 2	25. 9
313707	6. 2	48. 1	24. 9	21. 8
313707	6. 4	55. 3	26. 3	23. 0
313707	6. 4	58. 0	28. 3	23. 9
313707	6. 2	51. 0	26. 8	22. 2
313707	6. 7	54. 6	24. 9	21. 9
313707	6. 5	53. 3	26. 1	21. 5
313707	6. 1	59. 2	28. 6	23. 5
313707	6. 0	53. 9	30. 0	24. 8
313707	5. 9	52. 9	27. 1	22. 3
313707	6. 6	55. 8	28. 2	22. 3
313659	6. 9	59. 2	26. 3	22. 5
313659	6. 8	61. 1	29. 7	24. 9
313659	7. 0	58. 0	25. 1	21. 7
313659	6. 6	58. 1	28. 1	23. 9
313659	6. 9	55. 2	26. 2	22. 7
313659	6. 9	56. 2	26. 3	22. 7
313659	6. 3	55. 3	28. 3	24. 3
313659	6. 9	60. 8	28. 7	24. 9
313659	6. 5	53. 1	30. 2	24. 6
313659	7. 0	67. 7	28. 7	24. 8
313662	6. 9	59. 0	26. 3	23. 3
313662	6. 9	60. 6	27. 9	24. 6
313662	6. 5	57. 6	26. 2	24. 0
313662	6. 4	57. 0	27. 3	23. 6
313662	7. 1	58. 3	27. 2	23. 2
313662	6. 1	52. 0	29. 7	25. 4
313662	6. 9	59. 2	27. 5	23. 3
313662	6. 8	58. 3	27. 6	23. 8
313662	6. 5	60. 9	30. 8	26. 0
Average	6. 56	57. 94	28. 39	24. 1
Greatest	7. 1	67. 7	33. 4	28. 2
Least	5. 9	48. 1	24. 9	21. 5

This subspecies can readily be distinguished from *Cochlostyla* (*Chrysallis*) *aspersa edgari* by its much more regularly elongate-ovate form and from *Cochlostyla* (*Chrysallis*) *aspera calavitana* by its much greater size.

COCHLOSTYLA (CHRYSALLIS) ASPERSA CALAVITANA Bartsch

Plate 113, Figure 5

1932. *Cochlostyla* (*Chrysallis*) *aspersa calavitana* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 342.

1933. *Helicostyla* (*Chrysallis*) *mindoroensis parallaxis* Clench and Archer, Papers Michigan Acad. Sci., Arts, Letters, vol. 17, p. 550, pl. 58, fig. 2; in part.

Shell small, elongate-ovate, rather dull in coloration, all but the last whorl very pale brown or buffish brown, the last whorl chestnut-brown. All except the early nuclear whorls are variegated with retractively curved, axial streaks of dull buff. These streaks vary considerably in width and distribution on the various turns and also in their form, each ranging from broad bands to fulgurations. The base is slightly darker than the posterior part of the last whorl. The interior of the aperture is pale blue, which color extends also over the inner portion of the peristome; the outer edge of the peristome is almost black. The inner edge of the columella is also blue like the interior of the aperture. Nuclear whorls 3, the first smooth, the rest gradually assuming the postnuclear sculpture, which consists of low, irregular, rather closely approximated, retractively curved incremental lines. In addition the postnuclear whorls are marked by the usual crisscross microscopic sculpture and indications of obsolete spiral striations. The postnuclear whorls are slightly rounded and appressed at the summit. There is a feeble angle at the periphery and the basal portion of the last turn is considerably protracted. The aperture is elongate-ovate; the peristome is broadly expanded and reflected. The reflection almost covers the umbilicus at the insertion of the columella. The parietal wall is covered by a moderately thick callus.

This race can at once be distinguished from the other members with the protracted base by its exceedingly small size.

The type (U.S.N.M. no. 313714) was collected by Pedro de Mesa on Mount Calavite near Paluan, Mindoro. It has 6.5 whorls and measures: Length, 55 mm; greater diameter, 26.8 mm; lesser diameter, 22.6 mm.

Five topotypes (U.S.N.M. no. 313715) from the same source yield the following measurements:

Number of whorls	Length	Greater diameter	Lesser diameter
	Mm	*Mm*	*Mm*
6.3	51. 7	25. 9	21. 9
6.4	53. 3	25. 0	20. 7
6.3	52. 7	24. 2	20. 0
6.2	50. 7	23. 2	20. 2
6.5	54. 8	26. 5	21. 8

COCHLOSTYLA (CHRYSALLIS) CANICEPS Bartsch

1932. *Cochlostyla* (*Chrysallis*) *caniceps* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 342.

Shell varying from elongate-ovate to elongate-conic in the different races. The nuclear whorls and probably the first postnuclear whorls in all of the races are flesh-color, sometimes soiled flesh-color. The last nuclear whorl and the light postnuclear whorls are bordered with a narrow zone of brown at the summit. The postnuclear whorls vary from almost flattened to fairly well rounded, and the periphery of the last whorl in some of the races is quite inflated; in others it is not inflated, but in all of them it is rounded and usually marked with a color line that separates the basal portion of the shell from the posterior part. The base, too, in some of the races is more inflated than in others. The postnuclear whorls are marked by retractively slanting bands or fulgurations of yellow or greenish yellow, which vary in width and strength and emphasis. These extend from the summit to the umbilical region. In some of the races on the last whorl they become more or less fused, and here the shell looks as if it were covered with a uniform motley periostracum. The interior of the aperture is bluish white, and the expanded peristome varies from white suffused with purplish brown to purplish brown in the different races. In all of them the outer edge of the peristome is bounded by a zone of purplish brown. This usually also extends up on the outer edge of the parietal callus. The postnuclear whorls are marked by retractively slanting, irregularly developed and spaced lines of growth, which give to the surface of the shell a somewhat rough appearance. The shaggy appearance obscures the fine microscopic crisscross sculpture, which crosses the lines of growth obliquely. The aperture is broadly oval; the outer lip is broadly expanded and reflected; the inner lip very broad at its insertion where it is reflected over the umbilicus, which it almost covers. The parietal area is covered by a rather thick callus.

This species seems to be widely distributed on the island of Mindoro. It probably ranges over the entire island and apparently breaks up into a number of races, so I give it a specific status here.

KEY TO THE SUBSPECIES OF COCHLOSTYLA (CHRYSALLIS) CANICEPS

- Shell brilliantly variegated .... demesai
- Shell not brilliantly variegated.
  - Shell rather dull in color.
    - Shell elongate-ovate.
      - Shell large; length more than 70 mm .... maita
      - Shell not large; length less than 65 mm .... contracostana
    - Shell elongate-conic.
      - Whorls almost flattened .... conica
      - Whorls rounded.
        - Length more than 55 mm .... caniceps
        - Length less than 50 mm .... minuta

COCHLOSTYLA (CHRYSALLIS) CANICEPS DEMESAI Bartsch

Plate 114, Figure 1

1932. *Cochlostyla* (*Chrysallis*) *caniceps demesai* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 342.

1933. *Helicostyla* (*Chrysallis*) *mindoroensis electrica* Clench and Archer, Papers Michigan Acad. Sci., Arts, Letters, vol. 17, p. 545; in part.

Shell elongate-ovate. The nuclear whorls are flesh-color. The early postnuclear whorls are pale brown, gradually turning to almost blackish brown on the last turn. On the early whorls a darkish zone is present also at the summit of the turns. Over this ground color more or less zigzag, retractively slanting, sometimes fulgurated lines of greenish buff are placed. These color markings extend from the summit to the umbilical chink. The aperture is bluish white within. The expanded peristome and a slight portion of the outer edge of the columella are smoky chocolate-brown, the dark color extending much farther within the aperture than in the other races. Nuclear whorls 3, well rounded. The last one is marked by a similar type of sculpture as that which characterizes the postnuclear turns. The postnuclear whorls are very narrowly shouldered at the summit and crossed by retractively curved lines of growth, which vary very much in strength, and also in spacing, but they are rather closely crowded. In addition the whorls are marked by the fine microscopic crisscross sculpture characteristic of the group. Aperture broadly oval. The peristome decidedly expanded and reflected. The inner lip is also expanded and reflected, rather decidedly so at its insertion where its reflection almost covers the umbilicus, leaving only a chink. The parietal wall is covered by a rather thick callus.

This race can at once be distinguished from the other subspecies by the fact that the color is much darker than in any of the others, the dark color on the peristome extending within the aperture, a feature not observed in any of the other forms of this species.

The type (U.S.N.M. no. 313552) was collected by Pedro de Mesa at Calamintao, Mamborao, Mindoro, which is southwest of Mount Halcon. The type has 6.8 whorls and measures: Length, 65 mm; greater diameter, 34.8 mm; lesser diameter, 27.8 mm.

Thirteen topotypes (U.S.N.M. nos. 313553 and 313651) measure:

U.S.N.M. no.	Number of whorls	Length	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
313553	6. 9	66. 5	38. 2	30. 8
313553	6. 9	67. 3	35. 0	27. 7
313553	6. 3	56. 8	30. 0	24. 8
313651	6. 7	66. 9	35. 8	28. 3
313651	6. 3	59. 5	32. 2	27. 7
313651	6. 4	60. 2	33. 3	27. 0
313651	6. 5	62. 2	33. 2	27. 3
313651	6. 2	62. 3	36. 8	30. 2
313651	7. 0	64. 6	32. 3	27. 3
313651	6. 7	62. 9	33. 8	28. 6
313651	6. 6	64. 9	37. 2	28. 4
313651	6. 4	64. 4	33. 0	28. 4
313651	6. 4	58. 3	34. 0	28. 3
Average	6. 56	62. 8	34. 2	28. 0
Greatest	7. 0	67. 3	38. 2	30. 8
Least	6. 2	56. 8	30. 0	24. 8

COCHLOSTYLA (CHRYSALLIS) CANICEPS MAITA Bartsch

Plate 114, Figure 7

1932. *Cochlostyla (Chrysallis) caniceps maita* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 342.

Shell rather large, elongate-ovate. The early nuclear whorls are soiled flesh-color; the last one is pale buff, and from that the shell grades on the last turn to the ground color, chestnut-brown. Over this are placed irregular more or less interrupted zones of grayish buff, which are best developed near the summit on the last turn; the stronger markings disappear on the last half. The aperture is bluish white, and the peristome is chocolate-brown with a purplish flush except the interior portion of the outer lip at its insertion, which again is flesh-color, while the parietal callus is pale brown. Nuclear whorls 3, the first smooth, the rest showing the markings of the postnuclear turns. The postnuclear whorls are marked by irregularly developed, closely spaced, retractively slanting, flattened threads and fine, ill-defined, subobsolete spiral striations. In addition they are marked by the usual crisscross microscopic sculpture, which cuts the lines of growth obliquely. Aperture broadly ovate; outer lip broadly expanded and reflected. The inner lip likewise broadly expanded and reflected, particularly at its insertion where it almost covers the umbilicus, leaving only a narrow chink. The parietal wall is covered by a rather thick callus.

The type (U.S.N.M. no. 20351a) was collected by the Exploring Expedition presumably at the southern tip of Mindoro. It has lost the first nuclear whorl. The 5.8 remaining measure: Length, 71 mm; greater diameter, 38 mm; lesser diameter, 29.6 mm.

A young specimen from the same source is entered under the same number.

This race is also a member of the ovate-conic group and most closely resembles *C. caniceps contracostana* but is much larger than that form. The chocolate-brown peristome is also darker and of more uniform color than in *contracostana*.

COCHLOSTYLA (CHRYSALLIS) CANICEPS CONTRACOSTANA Bartsch

Plate 114, Figure 2

1932. *Cochlostyla (Chrysallis) caniceps contracostana* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 343.

Shell elongate-ovate. The early nuclear whorls are flesh-color, the last one pale buff, the succeeding turns gradually shade from this to light brown and to dark chestnut-brown. In the lighter turns there is a zone of light brown near the summit. In addition the whorls are marked by retractively curved bands of pale buff or greenish buff.

These bands are of irregular width, shape, and spacing. On the last whorl they extend to the umbilical chink. The aperture is bluish white, and the peristome is edged with chestnut-brown. This color gradually fades inward until it merges with the white of the aperture at their junction. The inner lip is edged with brown, which also extends over the outer edge of the parietal callus. Nuclear whorls 2.9, the first smooth and the last one showing the markings of the postnuclear whorls. The postnuclear whorls are very narrowly shouldered at the summit and are crossed by irregularly developed and spaced, retractively slanting, almost threadlike lines of growth, which are quite closely approximated. These pass over the periphery and base of the last whorl to the umbilical chink. In addition to this sculpture, the whorls are marked by the usual microscopic crisscross lines, which cut the lines of growth obliquely. The periphery of the last whorl is somewhat inflated, well rounded. The periphery is marked by a slender color line, which defines the border line between the spire and base. Base well rounded. Aperture broadly oval; outer lip expanded and reflected; inner lip decidedly expanded at its insertion, also reflected, covering the umbilicus excepting a broad chink. The parietal wall is covered by a moderately thick callus.

The type (U.S.N.M. no. 313554) was collected by Mr. Quadras and is labeled, "Contra Costa de Mindoro." It has 6.1 whorls and measures: Length, 62 mm; greater diameter, 35.2 mm; lesser diameter, 26 mm.

This race belongs to the elongate-ovate group and can be readily differentiated from *C. caniceps demesai* by its less brilliant coloration and smaller size and from *C. caniceps maita* by its smaller size.

COCHLOSTYLA (CHRYSALLIS) CANICEPS CONICA Bartsch

PLATE 114, FIGURE 6

1932. *Cochlostyla* (*Chrysallis*) *caniceps conica* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 343.

Shell rather large, very regularly elongate-conic. The first two nuclear whorls flesh-color; the last one pale buff, which is also the color of the succeeding turn, but this rapidly shades into the chestnut color of the last two whorls. In addition the whorls are marked by irregularly placed axial bands of yellowish buff, which leave the brown interspaces on the posterior half of the turns very conspicuous. The basal half of the last whorl is almost unicolor, the darker parts showing through only in spots and the last portion of the last turn is also of this more or less solid color. The interior of the aperture is bluish white, and the expanded peristome is pale purplish brown with a narrow zone of dark purplish brown at the edge. This color also marks the outer edge of the peripheral callus. Nuclear whorls 3, the first two well rounded, and smooth, the last one showing the beginning of the postnuclear sculpture. The postnuclear whorls are narrowly shouldered, almost flattened, and marked by irregular, decidedly retractively curved, almost threadlike incremental lines, which are closely approximated and which extend on the last whorl from the summit to the umbilical chink. In addition the whorls are marked by ill-defined spiral threads and the usual crisscross microscopic incised lines, which cut the lines of growth obliquely, both protractively and retractively. The aperture is oblique and broadly oval, with the outer lip decidedly expanded and reflected. The inner lip is also expanded, decidedly so at its insertion where it is reflected over the umbilicus, of which it leaves only a very narrow chink. The parietal wall is covered by a rather thick callus.

The type (U.S.N.M. no. 313555) was collected by von Möllendorff in southwestern Mindoro. It has 7 whorls and measures: Length, 73.1 mm; greater diameter, 36.9 mm; lesser diameter, 27.9 mm.

This subspecies can readily be distinguished from the others by its regularly conic outline.

COCHLOSTYLA (CHRYSALLIS) CANICEPS CANICEPS Bartsch

PLATE 114, FIGURE 5; PLATE 115

1932. *Cochlostyla* (*Chrysallis*) *caniceps caniceps* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 343.

Shell elongate-conic. The first nuclear portion is flesh-color, which is succeeded by pale buff gradually shading into the dark chestnut-color of the last turn. In the early light-colored whorls there is a narrow zone of brown near the summit. In addition the whorls are marked by fulgurations and bands of pale-buff or yellowish-buff axial bands, which on the last whorl extend from the summit to the umbilical chink. The last whorl also shows a peripheral dark line separating the spire from the basal portion. The aperture is bluish white edged with dark chestnut-brown, which also extends over the outer portion of the peripheral callus. Nuclear whorls 2.8, the first two smooth, the last one showing the beginning of the postnuclear sculpture. The postnuclear whorls are very narrowly shouldered at the summit and crossed by retractively curved, irregular, and irregularly developed lines of growth, which are rather closely approximated and do not merit the term of threads. There are also fine, obsoletely incised spiral lines and the usual microscopic crisscross sculpture, which cuts the lines of growth obliquely both protractively and retractively on spire and base. The aperture is broadly ovate. The outer lip broadly expanded; the inner lip also expanded, decidedly so at its insertion where it is reflected over the umbilicus, of which it leaves only a narrow chink. Parietal wall covered by a rather heavy callus.

The type (U.S.N.M. no. 313556) was collected by the Menage Scientific Expedition, that is, by Drs. Worcester and Bourns, at Lake Naujan, Mindoro. It has 6 whorls and measures: Length, 59.3 mm; greater diameter, 30 mm; lesser diameter, 23.2 mm.

A hundred additional specimens (U.S.N.M. no. 313557) yield the following measurements:

Number of whorls	Length	Greater diameter	Lesser diameter
	Mm	*Mm*	*Mm*
6.0	55.6	25.6	21.7
6.0	56.3	27.1	21.6
6.1	50.8	22.8	20.8
6.1	56.5	26.7	22.4
6.1	54.5	26.2	22.2
6.0	58.5	29.4	24.1
6.0	54.3	25.9	21.8
6.0	50.2	24.2	21.3
6.1	59.5	26.3	22.7
6.0	52.3	26.3	21.4
6.0	53.0	25.8	21.8
6.0	52.2	27.6	22.8
5.9	55.2	25.3	21.7
6.0	55.8	27.0	22.0
6.0	60.3	28.0	24.2
6.0	58.7	27.5	23.4
6.0	52.4	24.9	22.3
5.9	50.0	24.8	21.9
6.0	53.5	29.0	22.2
6.0	50.2	23.6	20.5
6.1	57.3	26.4	21.8
6.2	52.3	28.2	22.2
6.1	56.8	25.0	22.0
5.9	51.6	26.6	21.7
6.2	52.0	25.5	21.8
6.2	54.7	27.3	22.2
6.1	56.6	26.9	23.0
6.2	57.8	27.9	23.8
6.0	50.7	26.4	22.3
6.1	48.7	28.7	22.5
6.0	57.0	27.0	22.7
6.1	53.3	26.7	21.7
6.0	56.5	27.3	21.5
6.1	54.4	26.9	22.5
6.2	54.8	27.4	22.6
6.1	59.6	29.5	23.3
6.0	56.7	27.6	23.1
6.1	55.9	29.0	22.9
6.0	50.8	23.4	21.7
6.2	54.5	27.4	22.6
6.2	60.6	27.8	23.1
6.0	61.6	29.0	23.7
6.1	54.7	28.7	21.8
6.0	61.6	28.5	22.8
6.0	60.9	31.1	23.5
6.1	52.2	26.9	21.8
5.9	61.5	29.8	22.9
6.2	56.9	26.3	21.0
6.1	52.0	24.8	22.5
6.2	50.6	25.8	22.0
6.1	58.0	28.9	22.3
6.1	55.0	26.4	21.8
6.2	56.4	26.4	22.8
6.0	58.4	28.8	24.1

Number of whorls	Length	Greater diameter	Lesser diameter
	Mm	*Mm*	*Mm*
6.0	54.9	26.5	23.4
6.0	61.5	30.0	24.0
6.0	56.2	27.2	21.7
5.9	48.5	25.2	21.0
6.0	52.0	25.4	20.1
5.9	54.4	25.0	20.8
6.0	54.5	24.5	21.8
6.2	59.8	29.8	23.6
6.0	55.5	28.8	22.7
5.9	51.6	26.9	22.7
6.1	59.1	27.2	22.6
6.1	52.5	25.5	21.1
6.0	50.7	26.6	22.7
6.1	56.9	28.2	22.2
6.1	53.4	26.3	21.9
6.1	58.0	27.6	24.2
6.0	54.0	26.4	21.8
6.1	53.8	24.5	20.7
6.0	51.9	27.8	22.9
6.1	55.9	25.3	21.3
6.0	52.6	26.5	21.8
6.2	53.2	27.1	22.3
5.9	57.8	26.6	22.0
5.9	52.3	25.7	20.6
6.0	53.6	28.3	24.2
6.0	51.6	24.4	21.2
5.9	56.7	27.0	22.9
6.0	54.8	28.2	22.9
6.1	50.5	24.5	23.0
6.1	56.8	27.6	22.2
6.0	54.2	25.9	22.3
6.2	60.2	30.0	21.7
5.9	50.1	24.9	24.4
6.1	51.2	24.4	21.0
6.1	47.6	24.4	21.5
5.8	58.6	27.6	21.0
5.9	57.8	27.8	22.0
6.1	50.2	26.2	22.0
6.2	55.6	27.8	21.0
6.0	59.0	28.4	22.3
5.8	42.0	21.4	21.0
6.0	50.0	26.0	19.5
6.1	54.0	24.0	23.2
5.9	48.4	24.8	22.2
5.9	48.6	25.0	20.5
5.9	48.6	25.0	20.7
6.039 [1]	[1] 54.53	[1] 26.685	[1] 22.19
6.2 [2]	[2] 61.6	[2] 31.1	[2] 24.4
5.8 [3]	[3] 42.0	[3] 21.4	[3] 19.5

[1] Average. [2] Greatest. [3] Least.

Our figure of 70 of these (pl. 115) shows how constant they are in characters. I have taken 70 specimens at random to convey the idea of the constancy of characters in the race *caniceps*, a constancy that holds equally good in the case of the races of *Cochlostyla* (*Chrysallis*) *aspersa*, *nigriceps*, etc. I call particular attention to this in order that it be understood that I am not dealing with selected specimens but with races of well-defined species.

COCHLOSTYLA (CHRYSALLIS) CANICEPS MINUTA Bartsch

PLATE 114, FIGURE 3

1932. *Cochlostyla* (*Chrysallis*) *caniceps minuta* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 343.

Shell very small, elongate-conic. The first two nuclear whorls are flesh-color, the next pale buff gradually shading into the darker chestnut-brown ground color of the last turn. In addition the shell is marked by rather irregular, small, retractively slanting, axial streaks of pale greenish buff. These are almost threadlike, but near the summit of the turns they are gathered together into broader areas, which give to this portion of the shell the aspect of being falsely toothed. The base of the last whorl is a little darker than the spire and demarked definitely at the periphery. The interior of the aperture is bluish white. The peristome is pale chocolate-brown with a bluish flush. The inner lip is bluish white with the same chocolate-brown edging. Nuclear whorls 3, the first smooth, the second showing fine crenulations near the summit and the last showing the sculpture of the postnuclear turns. The postnuclear whorls are very feebly shouldered at the summit, moderately rounded, and marked by retractively curved, very irregular, roughish incremental threads, which pass over the periphery to the umbilicus of the last turn. The usual crisscross microscopic lines show wherever there is sufficient smoothness for it to become apparent. The aperture is broadly oval; the outer lip expanded and reflected; inner lip also decidedly expanded at its insertion and reflected over the umbilicus, which it almost covers. The parietal wall is covered with a thin callus.

The type (U.S.N.M. no. 313560) was collected by von Möllendorff at Mansalay, Mindoro. It has 5.5 whorls and measures: Length, 46 mm; greater diameter, 25.2 mm; lesser diameter, 20.7 mm.

Another specimen from the same source (U.S.N.M. no. 195431a) has 6.1 whorls and measures: Length, 51.3 mm; greater diameter, 25.2 mm; lesser diameter, 21.2 mm.

This race is most nearly related to *C. caniceps caniceps* but differs from it by its much smaller size and its little shaggier sculpture.

COCHLOSTYLA (CHRYSALLIS) NIGRICEPS Bartsch

1932. *Cochlostyla* (*Chrysallis*) *nigriceps* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 343.

Shell elongate-ovate, with the base of the last whorl rather produced. The nuclear whorls are chocolate-brown; the postnuclear whorls are covered with a rather strong periostracum, which is marked by irregular zones and fulgurations of yellowish straw-color and brown. The interior of the aperture is bluish white. The expanded peristome is brown, fading to the bluish white on its inner margin. There is a faint peripheral brownish zone. The parietal callus is also marked with a dark edge. Nuclear whorls 3, the first smooth, the last showing the sculpture of the postnuclear whorls. The postnuclear whorls are appressed at the summit, moderately rounded, and rendered rather rough by irregularly developed and somewhat irregularly spaced retractively curved incremental threads, which on the last whorl extend to the umbilical region. They are also marked by poorly expressed, fine spiral striations and the usual fine microscopic crisscross incised lines that cut the lines of growth at right angles. The aperture is broadly oval; the peristome is decidedly expanded and reflected, that of the inner lip being broadly expanded at its insertion where it is reflected over the umbilicus, which it almost covers. The parietal wall is covered by a rather thick callus.

This species recalls strongly *Cochlostyla* (*Chrysallis*) *caniceps*, from which it can at once be distinguished by its dark nuclear turns. So far it is known from the eastern and southwestern coasts of Mindoro. I am recognizing three races of it: *Cochlostyla* (*Chrysallis*) *nigriceps nigriceps*, from the region of Lake Naujan; *C.* (*C.*) *n. nubifer*, from southwestern Mindoro; and *C.* (*C.*) *n. obnubila* from Binuangan, northwestern Mindoro.

KEY TO THE SUBSPECIES OF COCHLOSTYLA (CHRYSALLIS) NIGRICEPS

Ground color chocolate-brown.
    Greater diameter more than 30 mm .... nubifer
    Greater diameter less than 30 mm .... nigriceps
Ground color blackish brown .... obnubila

COCHLOSTYLA (CHRYSALLIS) NIGRICEPS NUBIFER Bartsch

Plate 113, Figure 1

1932. *Cochlostyla* (*Chrysallis*) *nigriceps nubifer* Bartsch, Journ. Washington Acad. Sci., vol. 22, p. 343.

Shell elongate-conic. All the nuclear whorls dark chocolate-brown. The postnuclear whorls are chestnut-brown overlaid with a rather thick periostracum, which is marked by fulgurations and cloudings of soiled straw-color. The base is considerably darker than the space between the summit and the periphery, the distinction between the two being indicated by a sharp line. Interior of the aperture bluish white; peristome chocolate-brown. The inner edge of the peristome gradually fades into the color of the aperture. The inner portion of the insertion of the columella is also light in tone, while the parietal callus is dark-edged. Nuclear whorls almost 3, the first smooth, the second one showing fine incremental lines, and the last one the rough sculpture of the postnuclear turns. The postnuclear turns are slightly rounded, appressed at the summit and marked by irregularly developed and spaced, retractively curved, threadlike incremental lines. In addition to the axial sculpture, the whorls are marked by mere indications of obsolete spiral lines and the usual microscopic crisscross sculpture. The aperture is broadly oval; peristome is broadly expanded. The columella is reflected over and almost covers the umbilical chink.

The type (U.S.N.M. no. 195408) was collected by von Möllendorff in southwestern Mindoro. It has 6.2 whorls and measures: Length, 63.6 mm; greater diameter, 32.2 mm; lesser diameter, 25.4 mm.

Six additional specimens without specific locality are referable here: Two from the Redfield collection (U.S.N.M. no. 309414) have 6.3 and 6 whorls and measure: Length, 63.2 and 58.1 mm.; greater diameter, 30.2 and 31.8 mm; lesser diameter, 24.1 and 25.3 mm, respectively. Two others (U.S.N.M. no. 104347), collected by Lieutenant Febiger, have 6 whorls each and measure: Length, 58.2 and 62.9 mm; greater diameter, 31.5 and 31.3 mm; lesser diameter, 24.3 and 24.9 mm, respectively. The last two (U.S.N.M. no. 315639) come from the Evezard collection. They have 6 whorls and measure: Length, 61.2 and 57 mm; greater diameter, 31.3 and 30.3 mm; lesser diameter, 55 and 54.6 mm, respectively.

This subspecies is nearest related to *Cochlostyla* (*Chrysallis*) *nigriceps nigriceps*, from which it is distinguished by its larger size.

COCHLOSTYLA (CHRYSALLIS) NIGRICEPS NIGRICEPS Bartsch

PLATE 113, FIGURE 3

1932. *Cochlostyla* (*Chrysallis*) *nigriceps nigriceps* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 343.

Shell elongate-ovate. The first half of the nuclear turns is pale chocolate-color, the rest dark chocolate-color. The postnuclear whorls are of a chocolate ground color, covered with a rather thick periostracum, which causes the surface of the shell to look axially streaked with yellowish straw-color and brown retractively slanting bands and fulgurations. There is a faint peripheral zone of brown present, and the base is inclined to be slightly darker than the posterior portion of the last whorl. The aperture is bluish white within, gradually changing to chocolate-brown on the expanded peristome. This brown coloration also extends over the edge of the parietal callus. The first nuclear whorl is well rounded and smooth, the next one shows the beginning of the lines of growth, and the third and last one is sculptured like the postnuclear turns. The postnuclear turns are moderately rounded, appressed at the summit, and marked by retractively curved, irregularly developed and irregularly spaced, somewhat threadlike, axial lines of growth, which are retractively curved. These extend over the base into the umbilical chink on the last whorl. In addition there are fine, poorly expressed, spiral striations and the crisscross sculpture referred to in the description of the species. The aperture is broadly oval; the peristome is strongly expanded reflected, particularly so in the anterior portion of the outer lip and also at the insertion of the columella where it is reflected over the umbilicus which it almost covers. The parietal callus is rather heavy.

The type (U.S.N.M. no. 313716) was collected at Lake Naujan Mindoro, by the Menage Expedition. It has 6.5 whorls and measures: Length, 62.8 mm; greater diameter, 28.8 mm; lesser diameter, 22.7 mm.

Ten additional specimens (U.S.N.M. no. 313717) from the type locality yield the following data:

Number of whorls	Length	Greater diameter	Lesser diameter
	Mm	*Mm*	*Mm*
6.2	57. 3	28. 0	22. 4
6.1	57. 6	28. 4	23. 2
5.9	53. 7	28. 3	24. 0
5.9	58. 7	28. 5	24. 0
6.0	52. 8	27. 8	22. 5
6.0	61. 0	27. 5	23. 8
6.4	62. 3	29. 8	23. 0
5.9	53. 8	27. 0	21. 8
5.8	52. 1	26. 0	21. 8
5.9	52. 0	26. 1	21. 3

Two specimens (U.S.N.M. no. 195431) from Mansalay Bay yield the following data: Number of whorls, 6.1 and 5.9; length, 56.3 and 54 mm, greater diameter, 28.8 and 27.4 mm; lesser diameter, 23.3 and 21.5 mm, respectively.

This subspecies is nearest related to *Cochlostyla* (*Chrysallis*) *nigriceps nubifer*, from which it is distinguished by its lesser size.

COCHLOSTYLA (CHRYSALLIS) NIGRICEPS OBNUBILA Bartsch

PLATE 113, FIGURE 2

1932. *Cochlostyla* (*Chrysallis*) *nigriceps obnubila* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 343.

Shell elongate-ovate. The nuclear whorls are very dark chocolate-brown. The first postnuclear whorl is intermediate in ground color between this and the rest of the postnuclear whorls, which are dark chestnut-brown. The postnuclear whorls are covered with a thin periostracum, which is irregularly banded, blotched, spotted, and clouded with hydrophanous markings of buff. The interior of the aperture is pale blue; the expanded peristome is bright blue, which is also the color of the outer columellar edge, the inner corresponding with the interior of the aperture. Nuclear whorls 3, the early ones showing incremental lines, the later ones the postnuclear sculpture.

The postnuclear whorls are rather high between summit and suture, appressed at the summit, very slightly rounded, and marked by retractively slanting incremental lines, which are almost threads and which are of varying width. In addition the postnuclear whorls are marked on both spire and base by fine spiral striations and the usual crisscross sculpture. The suture is moderately constricted. The periphery is obsoletely angulated. There is no dark zone differentiating the base from the spire. The base is produced, well rounded; aperture oval; the outer lip broadly expanded and reflected. The columella is likewise rather broadly expanded at its insertion and reflected to leave only a narrow umbilical chink.

The type (U.S.N.M. no. 313718), collected by Mr. de Mesa at Binuangan, Municipality of Paluan, northwest Mindoro, has 6.4 whorls and measures: Length, 61.7 mm; greater diameter, 29.8 mm; lesser diameter, 24.6 mm.

Two topotypes (U.S.N.M. no. 313719) from the same source yield the following measurements: 6.2 and 5 whorls; length, 60.2 and 55.2 mm; greater diameter, 29.7 and 26.2 mm; lesser diameter, 24.5 and 21.8 mm, respectively.

This subspecies is readily distinguished from the others by having the ground color blackish brown, therefore much darker than the other two subspecies. Also, the hydrophanous clouding is lighter and much more pronounced.

COCHLOSTYLA (CHRYSALLIS) PERTURBATOR Bartsch

PLATE 114, FIGURE 4

1932. *Cochlostyla* (*Chrysallis*) *perturbator* BARTSCH, Journ. Washington Acad. Sci., vol. 22, p. 343.

1933. *Helicostyla* (*Chrysallis*) *mindoroensis ilogana* CLENCH and ARCHER, Papers Michigan Acad. Sci., Arts, Letters, vol. 17, p. 545, pl. 58, fig. 4 (not *ilogana* Bartsch, 1932).

The shell is of medium size, ovate. The early nuclear whorls are white; the later and the early postnuclear whorls are buff with a slender brownish line near the summit. The next to the last whorl is pale chestnut-color, while the last one has almost a blackish-brown ground color. The postnuclear whorls are covered with a moderately thick periostracum, which is crossed by hydrophanous bands, cloudings, or fulgurations of olivaceous-buff between which the ground color shines through. On the last turn in most of our specimens the hydrophanous portion is almost complete. The interior of the aperture is pale blue. The expanded peristome is chocolate-brown with an iridescent flush. This is also the color of the outer portion of the expanded inner lip, the inner portion coinciding with the color scheme of the interior of the aperture. Nuclear whorls 3.2, the first smooth, the succeeding marked by lines of growth, which gradually become intensified on the remaining whorls until they reach the strength of the postnuclear sculpture. The later turns are also marked by microscopic fine spiral striations. The postnuclear whorls are inflated and moderately rounded, appressed at the summit and crossed by numerous, closely spaced, almost threadlike, retractively curved, lines of growth, which extend over both spire and base. In addition the entire shell is marked with numerous microscopic, closely spaced, incised spiral lines and the usual fine crisscross sculpture. The aperture is broadly oval; the outer lip is decidedly expanded and reflected; the columella is also expanded and reflected to form a moderately large umbilcus. The parietal wall is covered by a thick callus.

The type (U.S.N.M. no. 313720), collected by Pedro de Mesa at Tara, Abra de Ilog, Mindoro, has 6.5 whorls and measures: Length, 55.2 mm; greater diameter, 31.6 mm; lesser diameter, 26.3 mm.

U.S.N.M. no. 313663 contains 23 topotypes, which yield the following data:

Number of whorls	Length	Greater diameter	Lesser diameter
	Mm	*Mm*	*Mm*
6.3	51. 4	28. 7	24. 1
6.0	51. 9	28. 4	23. 7
6.2	50. 0	28. 2	23. 5
6.5	54. 1	29. 0	23. 9
6.1	49. 0	29. 6	23. 2
6.3	49. 5	27. 8	23. 1
6.4	53. 2	28. 0	23. 4
6.1	50. 0	29. 0	23. 3
6.1	51. 9	29. 7	23. 3
5.9	49. 8	30. 8	25. 0
6.0	53. 2	28. 9	25. 0
6.3	54. 7	29. 4	24. 0
6.1	53. 6	30. 4	24. 5
6.4	58. 2	32. 5	26. 5
6.2	56. 3	29. 4	24. 7
6.7	57. 5	29. 3	24. 0
6.2	52. 4	27. 3	23. 6
5.9	48. 3	28. 6	22. 7
6.1	52. 9	26. 3	23. 1
5.8	48. 0	29. 3	24. 4
6.1	54. 6	31. 9	25. 1
6.0	50. 6	28. 4	23. 4
6.5	51. 7	29. 1	24. 1
6.2 [1]	[1] 52. 28	[1] 29. 2	[1] 23. 91
6.7 [2]	[2] 58. 2	[2] 32. 5	[2] 26. 5
5.8 [3]	[3] 48. 0	[3] 26. 3	[3] 22. 7

[1] Average.

[2] Greatest.

[3] Least.

U.S.N.M. no. 313660 contains 14 specimens also collected by Pedro de Mesa at Anduyanan, Paluan, Mindoro, which yield the following measurements:

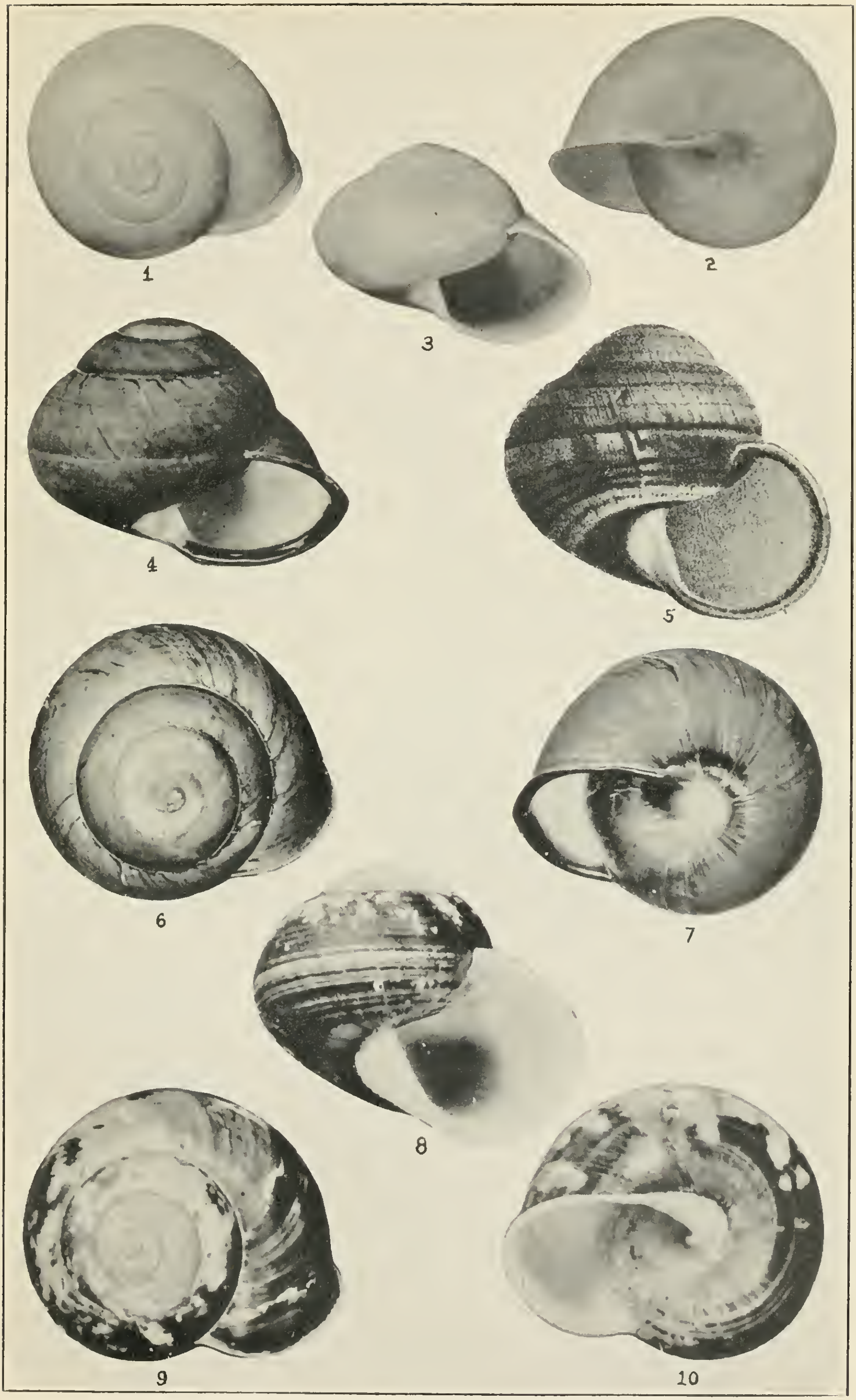
Number of whorls	Length	Greater diameter	Lesser diameter
	Mm	*Mm*	*Mm*
6.2	55. 7	30. 9	25. 7
6.5	58. 0	31. 7	25. 0
6.0	52. 2	28. 7	23. 5
6.5	59. 3	31. 4	25. 2
6.1	52. 1	30. 6	25. 0
6.1	54. 0	31. 5	26. 0
6.2	53. 3	32. 3	26. 7
6.5	52. 3	29. 0	23. 9
6.1	52. 6	30. 2	23. 5
6.3	56. 6	28. 7	24. 5
6.2	57. 7	33. 3	26. 8
6.0	51. 0	30. 3	24. 9
6.1	52. 5	28. 7	23. 9
6.1	52. 7	29. 7	24. 5
6.2 [1]	[1] 54. 28	[1] 30. 5	[1] 24. 93
6.5 [2]	[2] 59. 3	[2] 33. 3	[2] 26. 8
6.0 [3]	[3] 51. 0	[3] 28. 7	[3] 23. 5

[1] Average.
[2] Greatest.
[3] Least.

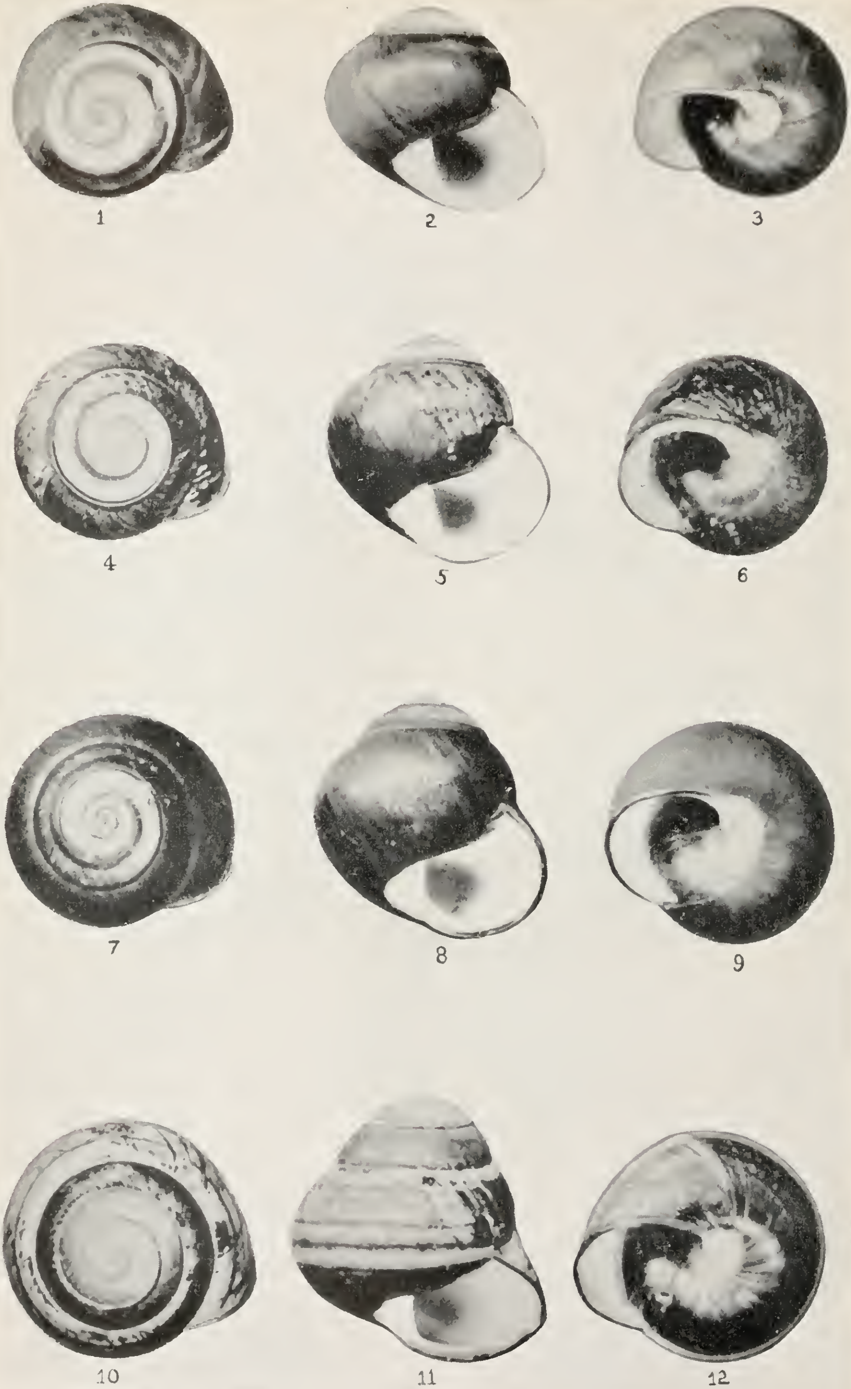
These agree so completely in every way with the specimen from Tara that I am wondering if a mistake may not have been made in their labeling. It is an extremely unusual state of affairs.

The ovate form, pale tip, exceedingly heavy periostracum, as well as the detail of color pattern, differentiate this species from the other Cochlostylas of Mindoro.

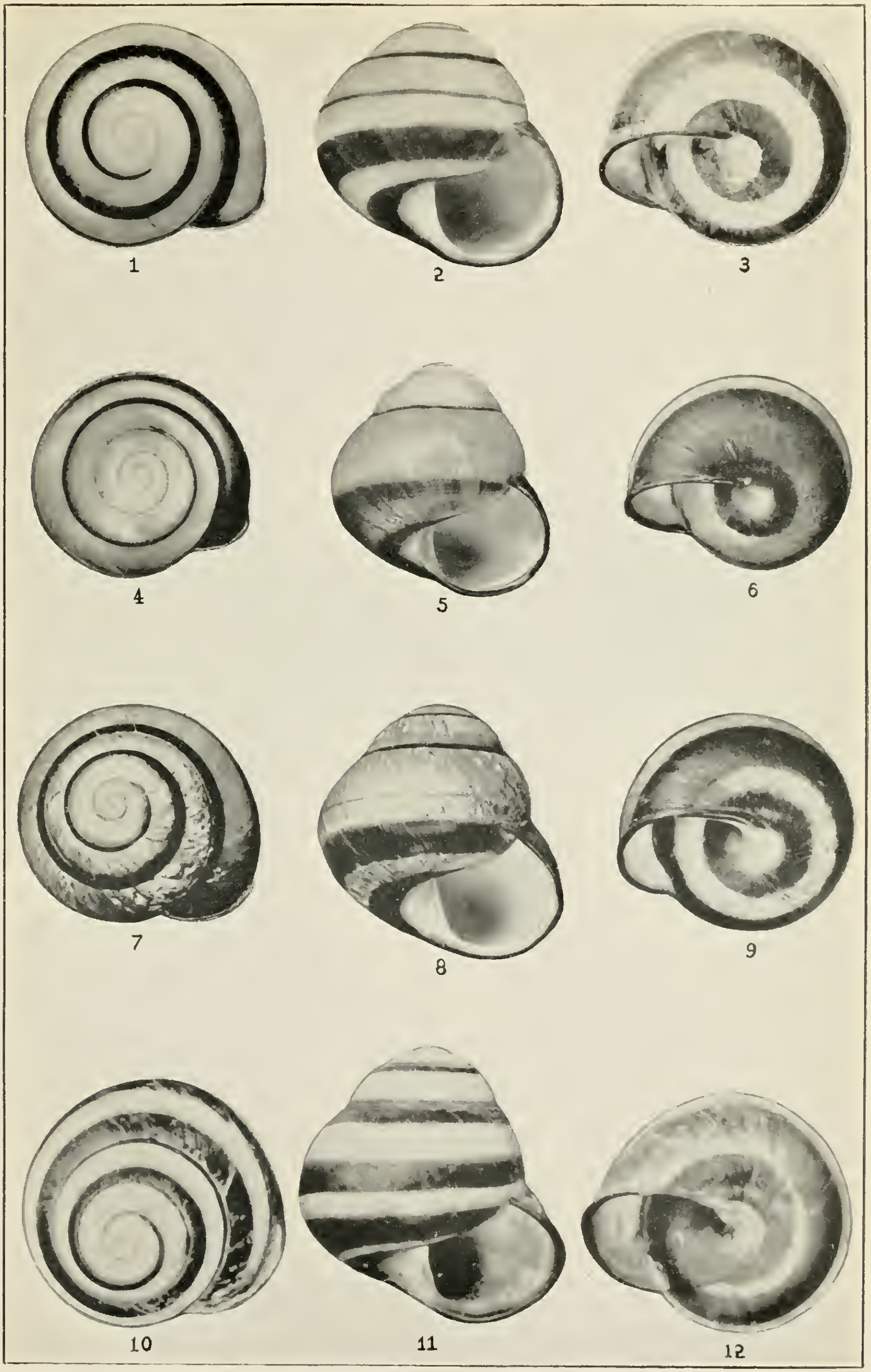
○



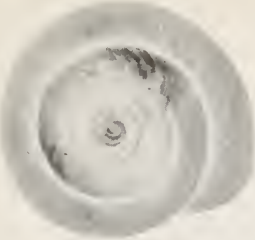
1-3, *Cochlostyla* (*Corasia*) *aegrota* (Reeve); 4-7, *C.* (*Calocochlea*) *melanocheila* (Pfeiffer); 8-10, *C.* (*C.*) *perpallida* Bartsch.

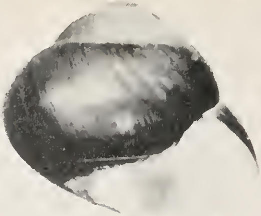

1
2
3
4
5
6
7
8
9
10
11
12

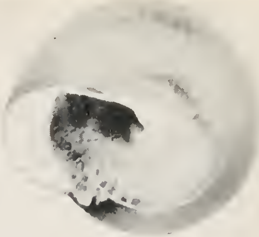
1-6, *Cochlostyla (Calocochlea) roissyana lutea* (Pfeiffer); 7-9, *C. (C.) r. subatra* Pilsbry; 10-12, *C. (C.) r. bartschi* Bartsch.

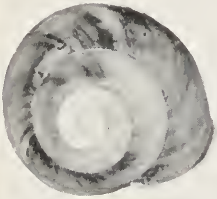


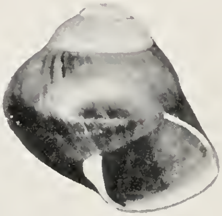
1–3, *Cochlostyla* (*Calocochlea*) *roissyana manlaysa* Bartsch; 4–6, *C.* (*C.*) *r. laymansa* Bartsch; 7–9, *C.* (*C.*) *r. roissyana* (Férussac); 10–12, *C.* (*C.*) *r. cavitala* Bartsch.

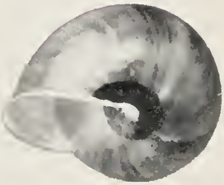

1

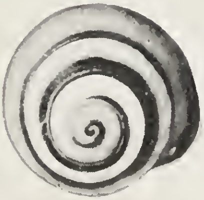

2

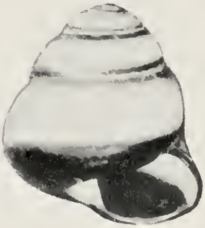

3

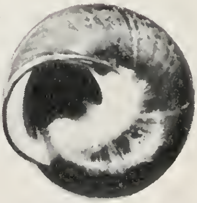

4

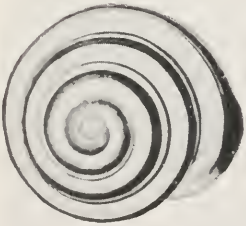

5

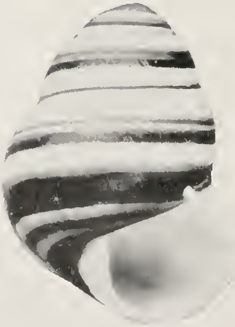

6

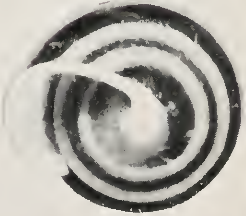

7


8

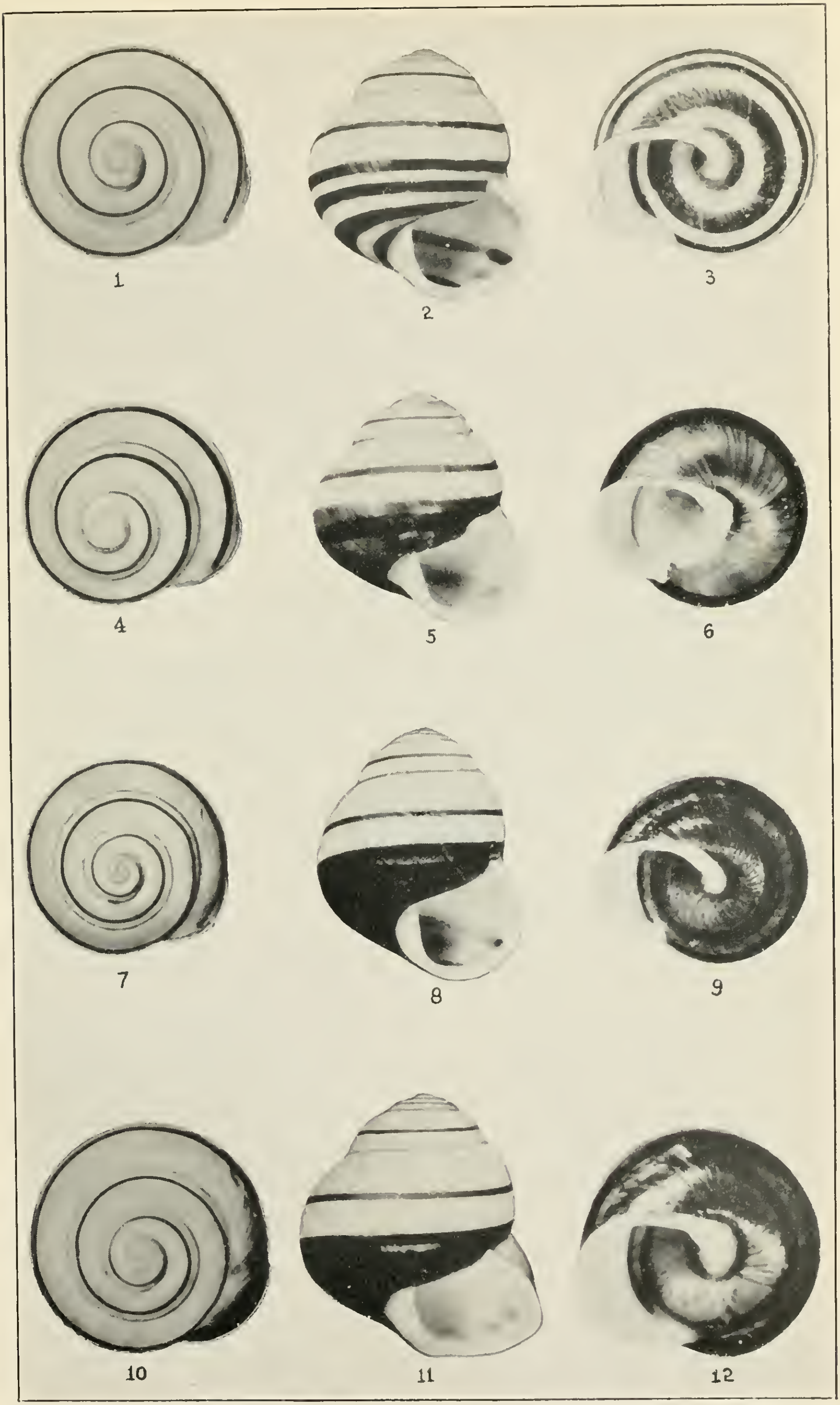

9


10

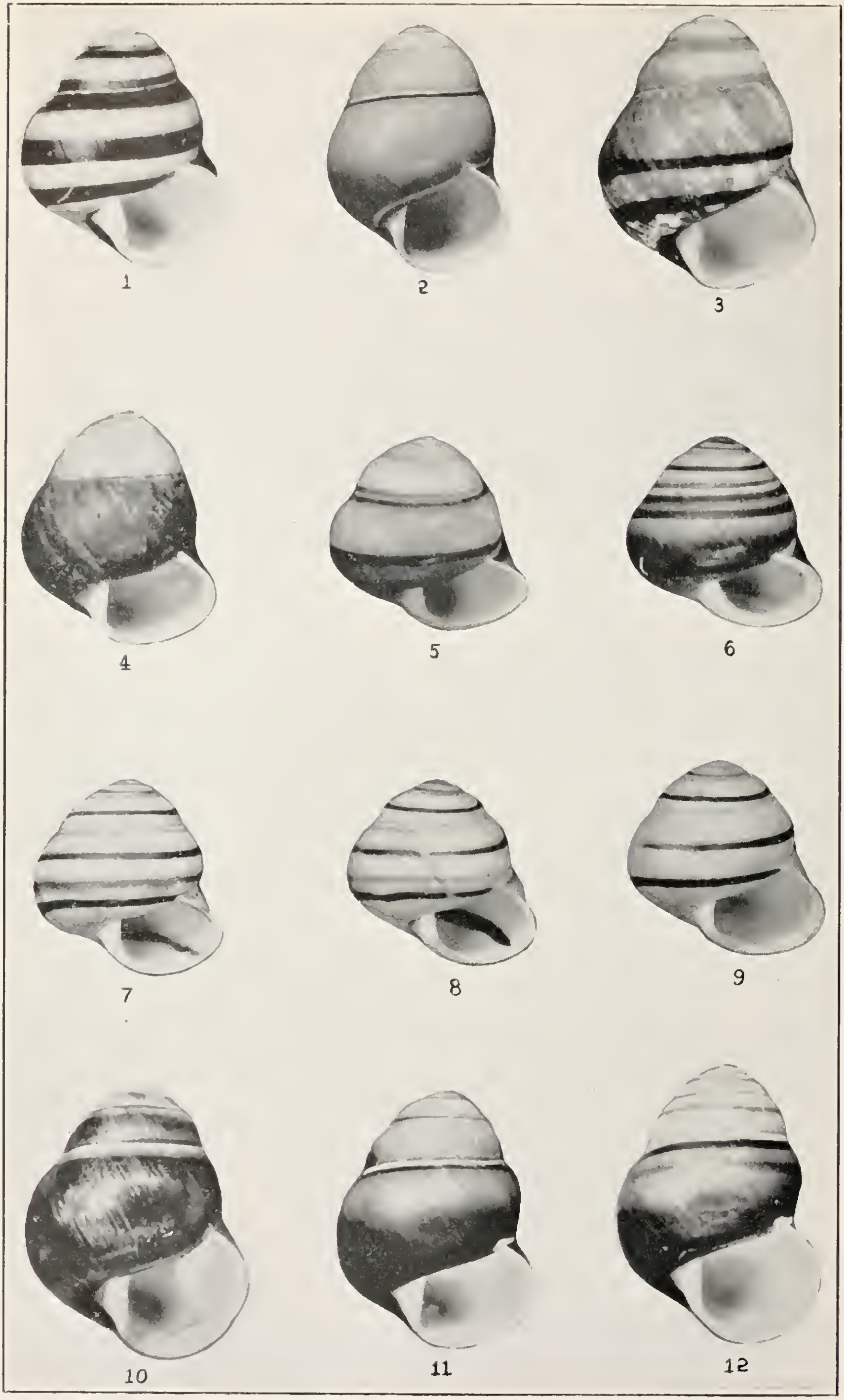

11


12

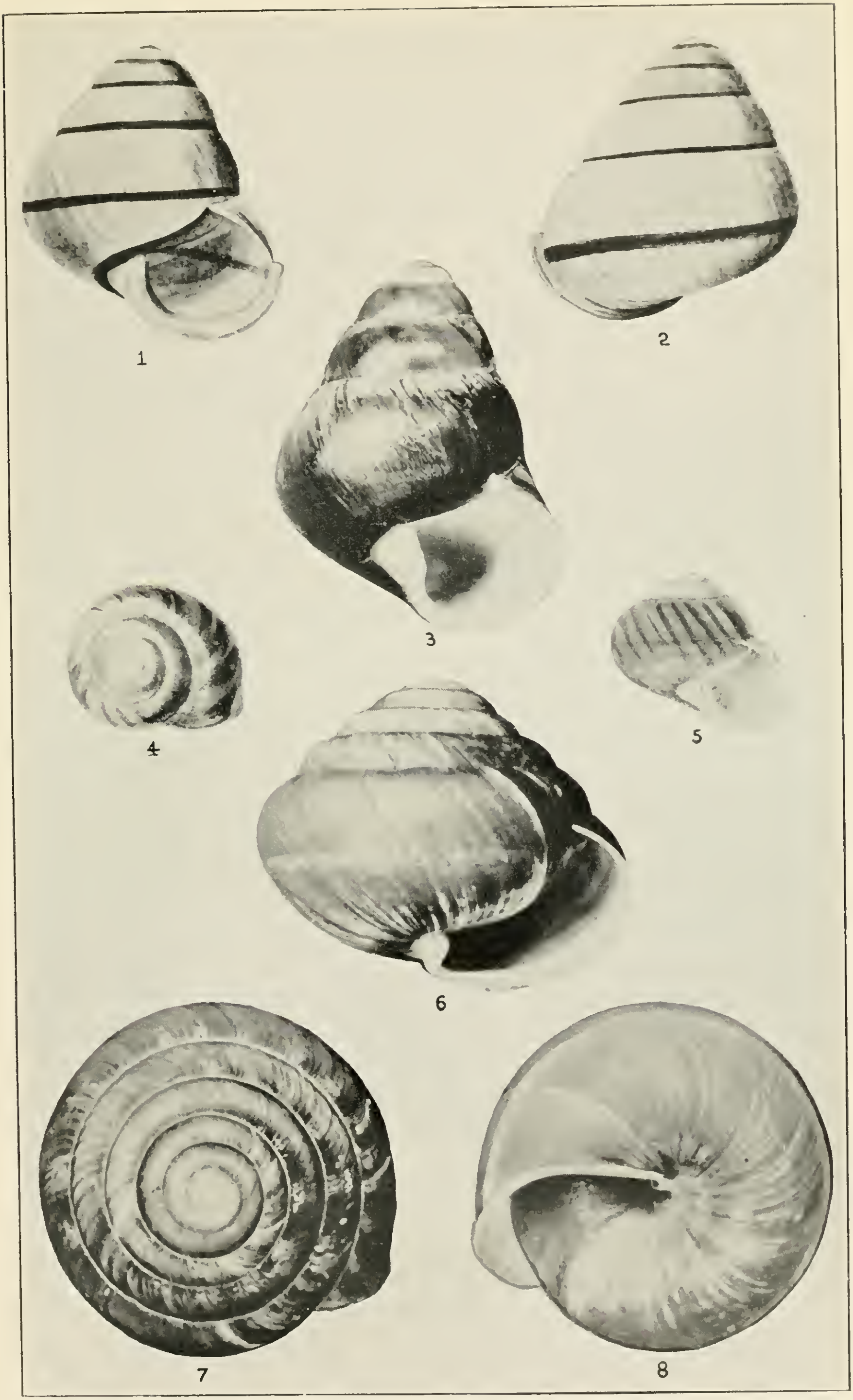
1–3, *Cochlostyla* (*Calocochlea*) *gertrudis* Möllendorff, Kobelt, and Winter; 4–6, *C.* (*Halocochlea*) *lillianae* Bartsch; 7–9, *C.* (*Helicostyla*) *dimera* (Jonas); 10–12, *C.* (*H.*) *fulgens johnsoni* Bartsch.


1
2
3
4
5
6
7
8
9
10
11
12

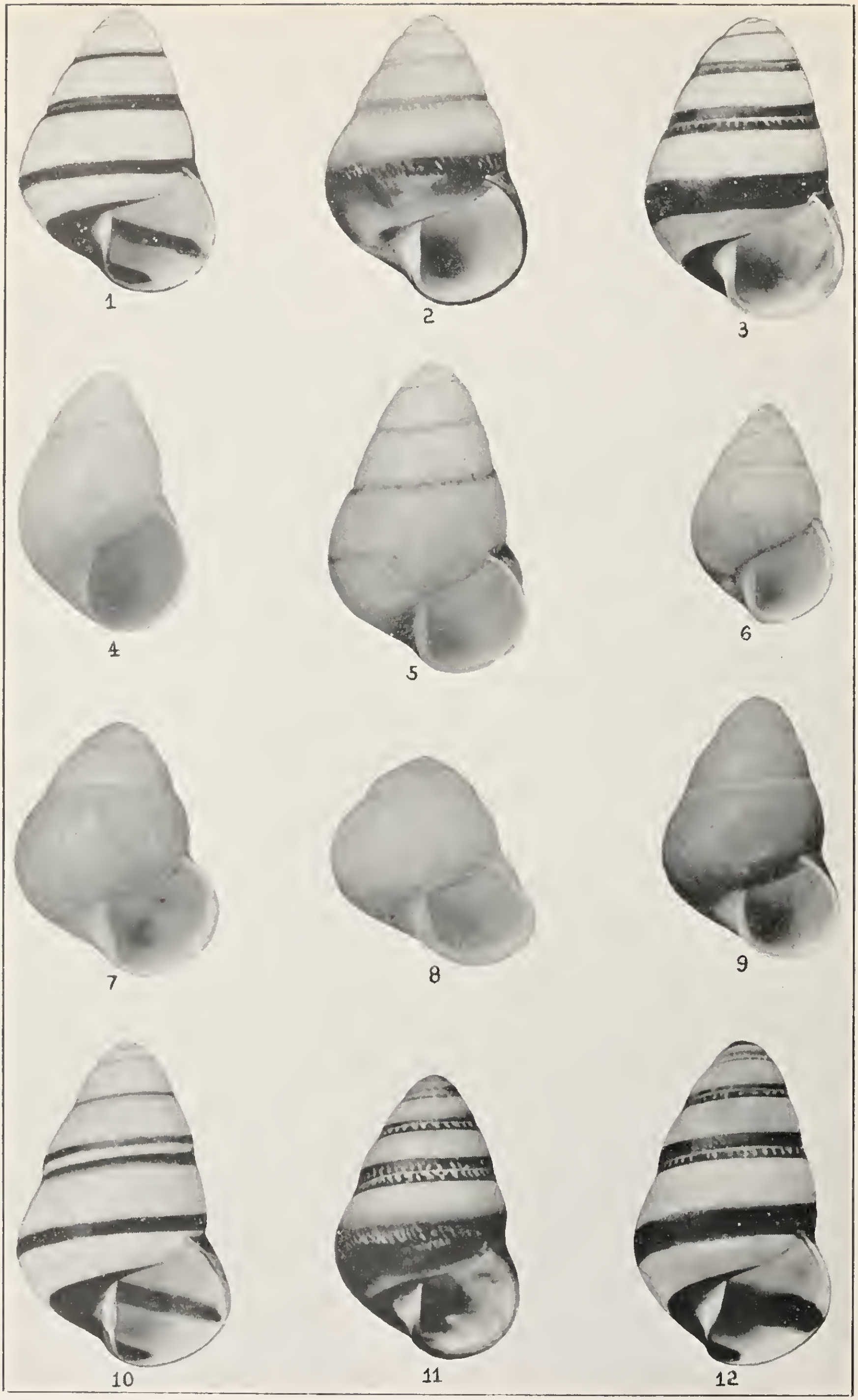
1-3, *Cochlostyla (Helicostyla) fulgens sapolana* Bartsch; 4-12, *C. (H.) f. fulgens* (Sowerby).



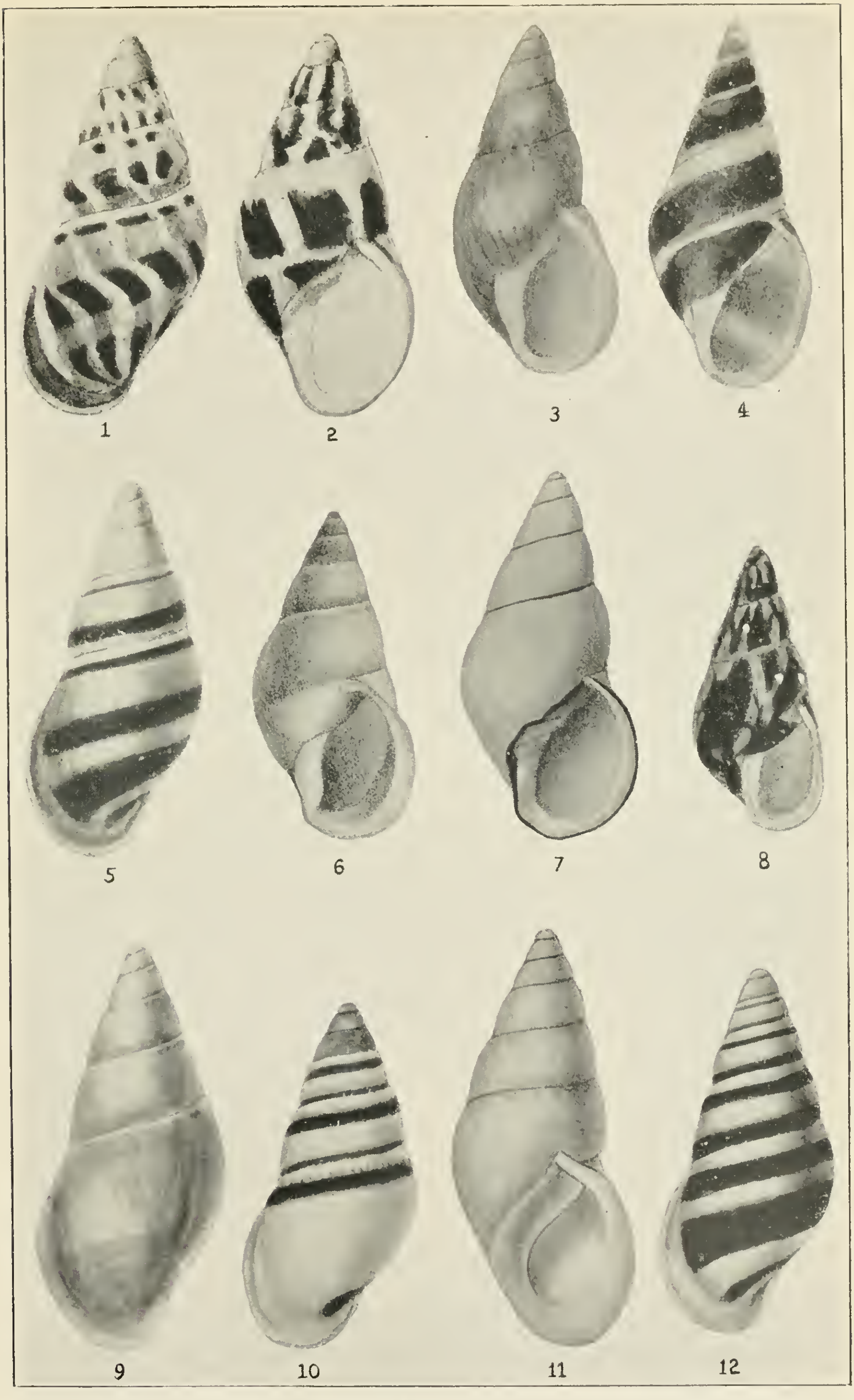
1, *Cochlostyla* (*Cochlostyla*) *hydrophana hydrophana* (Sowerby); 2, *C.* (*Cochlodryas*) *florida signa* Bartsch; 3, *C.* (*Cochlostyla*) *hydrophana varaderoana* Bartsch; 4, *C.* (*Cochlodryas*) *florida helicoides* (Pfeiffer); 5, *C.* (*C.*) *fastidiosa* Bartsch; 6, *C.* (*C.*) *orbitula* (Sowerby); 7, 8, *C.* (*C.*) *mateoi mateoi* Bartsch; 9, *C.* (*C.*) *m. sibolonensis* Bartsch; 10, *C.* (*C.*) *florida fuscolabiata* Möllendorff, Kobelt, and Winter; 11, *C.* (*C.*) *f. aureola* Bartsch; 12, *C.* (*C.*) *f. florida* (Broderip).



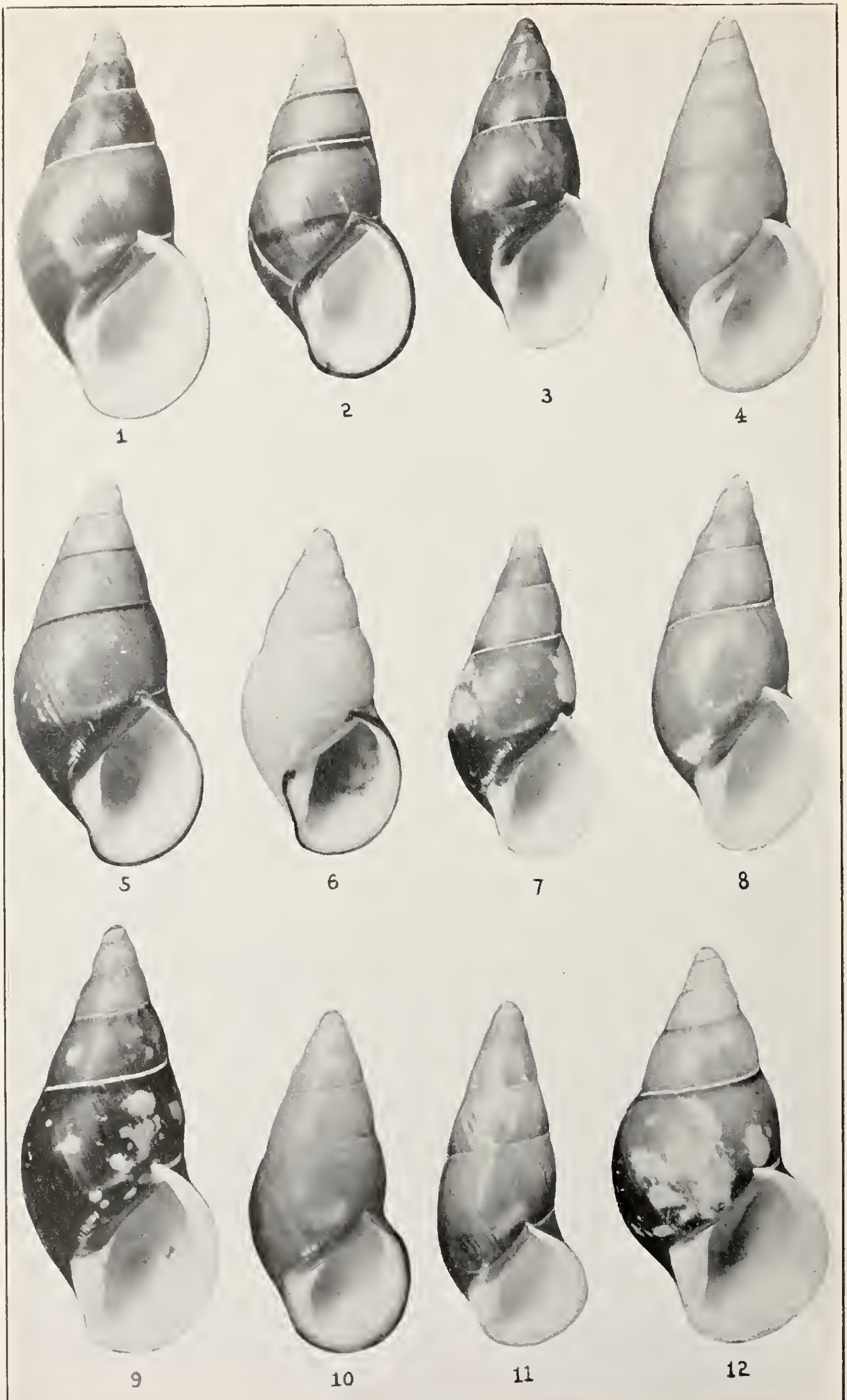
1, 2, *Cochlostyla* (*Helicobulinus*) *turbo* (Pfeiffer); 3, *C.* (*Orthostylus*) *euconica* Bartsch; 4, 5, *C.* (*Cochlodryas*) *decora* (Adams and Reeve); 6–8, *C.* (*Steatodryas*) *cepoides* (Lea).



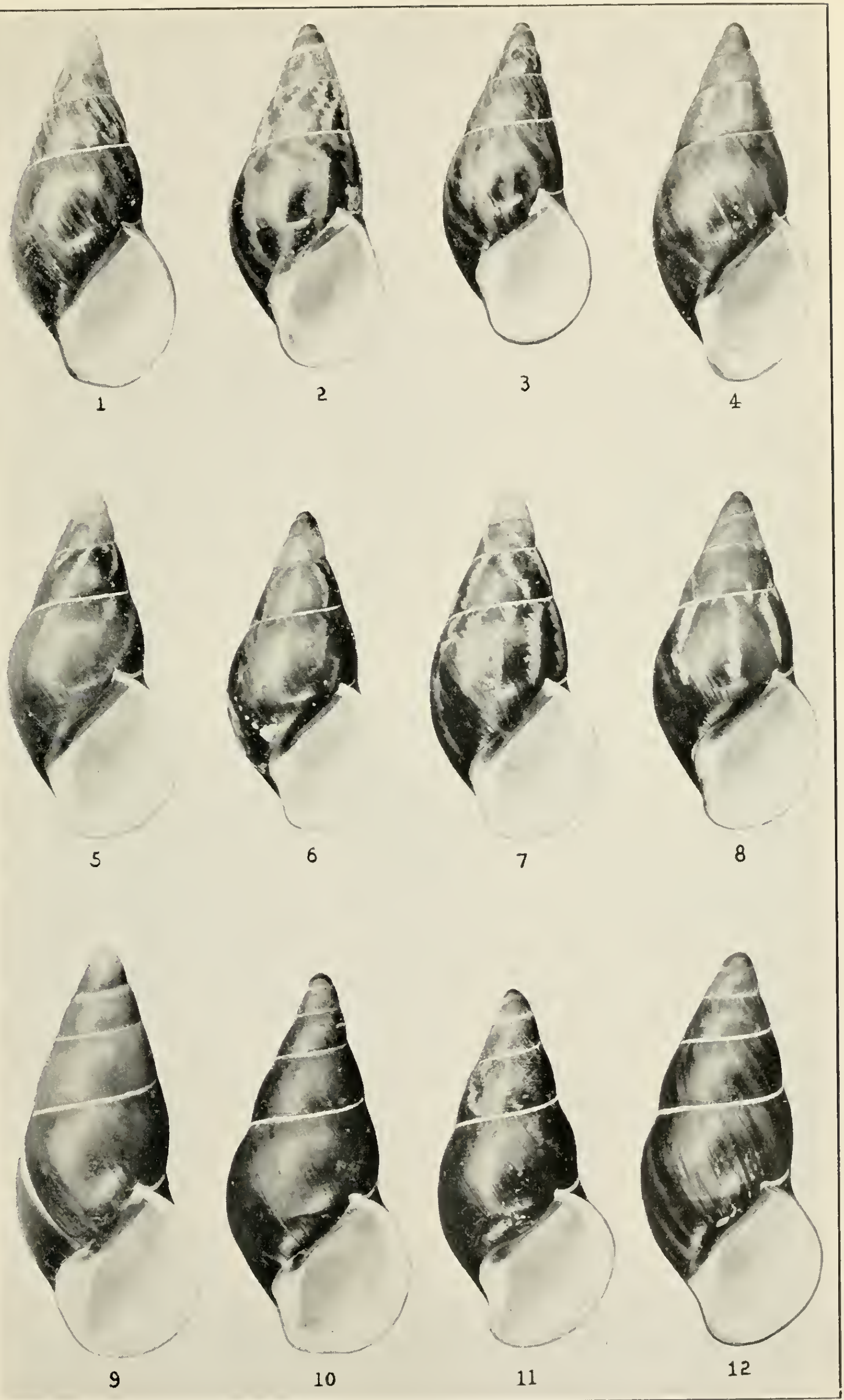
1, *Cochlostyla* (*Hypselostyla*) *cincinniformis menagei* Bartsch; 2, *C.* (*H.*) *c. ultima* (Clench and Archer); 3, *C.* (*H.*) *c. guntingana* Bartsch; 4, *C.* (*Eudoxus*) *albina* (Grateloup); 5, *C.* (*H.*) *c. lubanensis* (Clench and Archer); 6, *C.* (*E.*) *simplex* (Jonas); 7, *C.* (*E.*) *jonasi* (Pfeiffer); 8, *C.* (*E.*) *canonizadoi* Bartsch; 9, *C.* (*E.*) *buschi* (Pfeiffer); 10, *C.* (*H.*) *cincinniformis cabrasensis* Bartsch; 11, *C.* (*H.*) *c. demesana* (Clench and Archer); 12, *C.* (*H.*) *c. cincinniformis* (Sowerby).



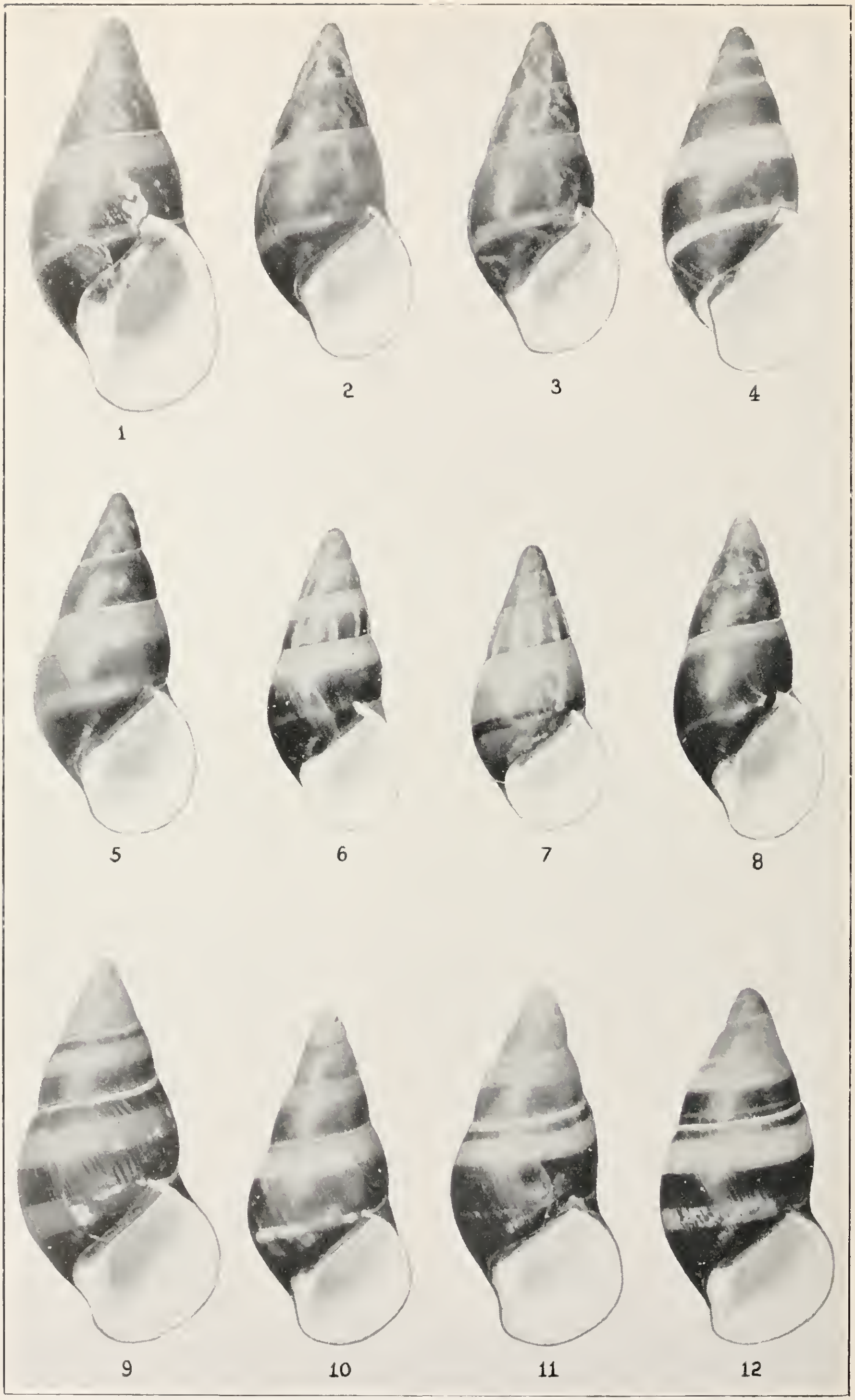
Copies of figures of shells upon which specific names were based and herein referred to *Cochlostyla* (*Prochilus*) *virgata* (Jay) (for detailed reference see pp. 458–459): 1, *Bulinus sylvanus* Broderip, *Cochlostyla* (*Prochilus*) *pulchrior* Pilsbry; 2, *Cochlostyla* (*Prochilus*) *pulchrior* Pilsbry; 3, *Bulimus porraceus* Jay; 4, *Bulimus virgatus* Jay; 5, *Bulinus sylvanus* Broderip; 6, *Bulinus labrella* Grateloup; 7, *Cochlostyla sylvanoides* Semper; 8, *Bulimus calobaptus* Jonas; 9, *Bulinus sylvanus* Broderip; 10–12, *Bulinus dryas* Broderip.


1
2
3
4
5
6
7
8
9
10
11
12

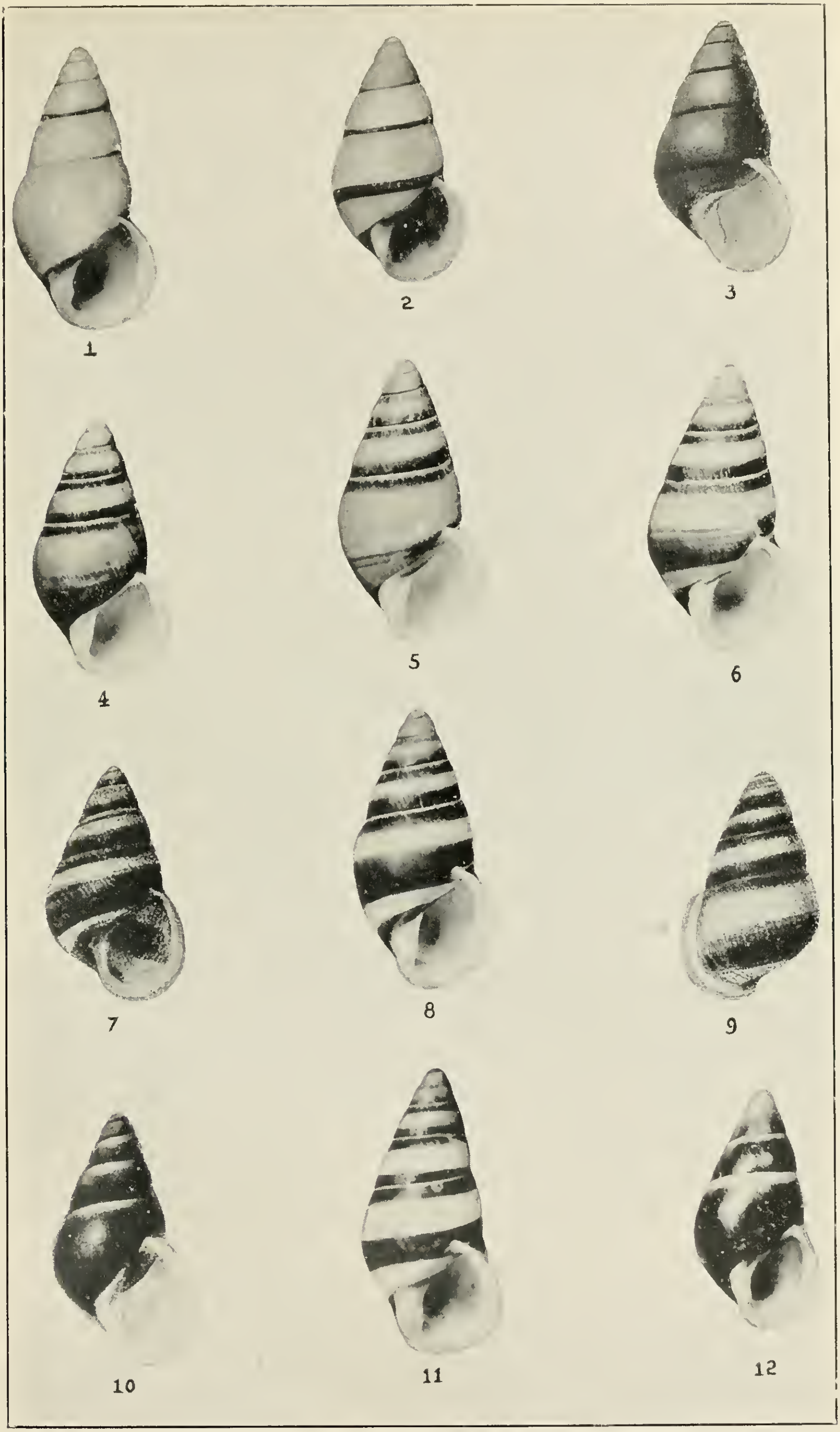
Mutations of *Cochlostyla* (*Prochilus*) *virgata* (Jay).


1
2
3
4
5
6
7
8
9
10
11
12

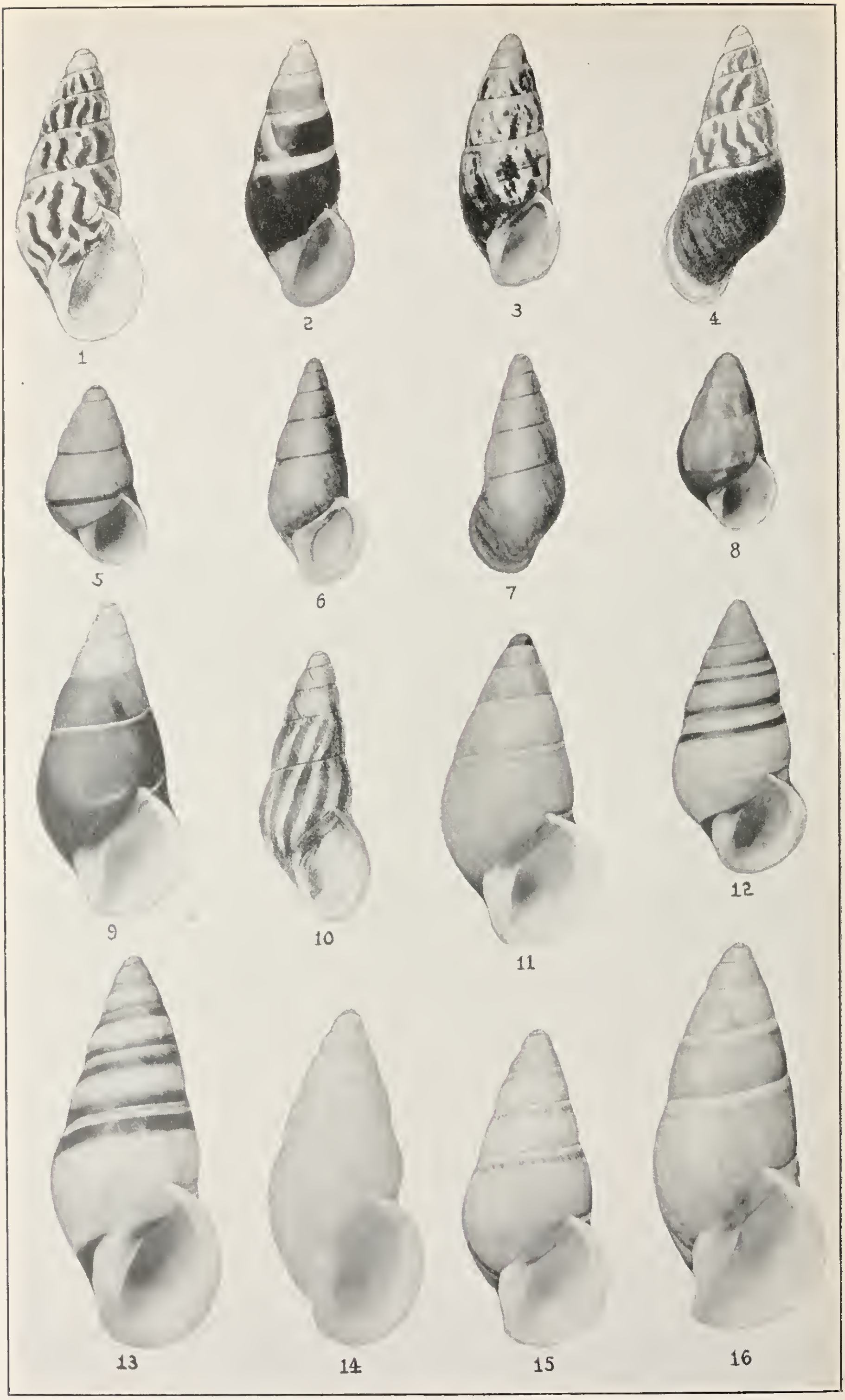
Mutations of *Cochlostyla* (*Prochilus*) *virgata* (Jay).


1
2
3
4
5
6
7
8
9
10
11
12

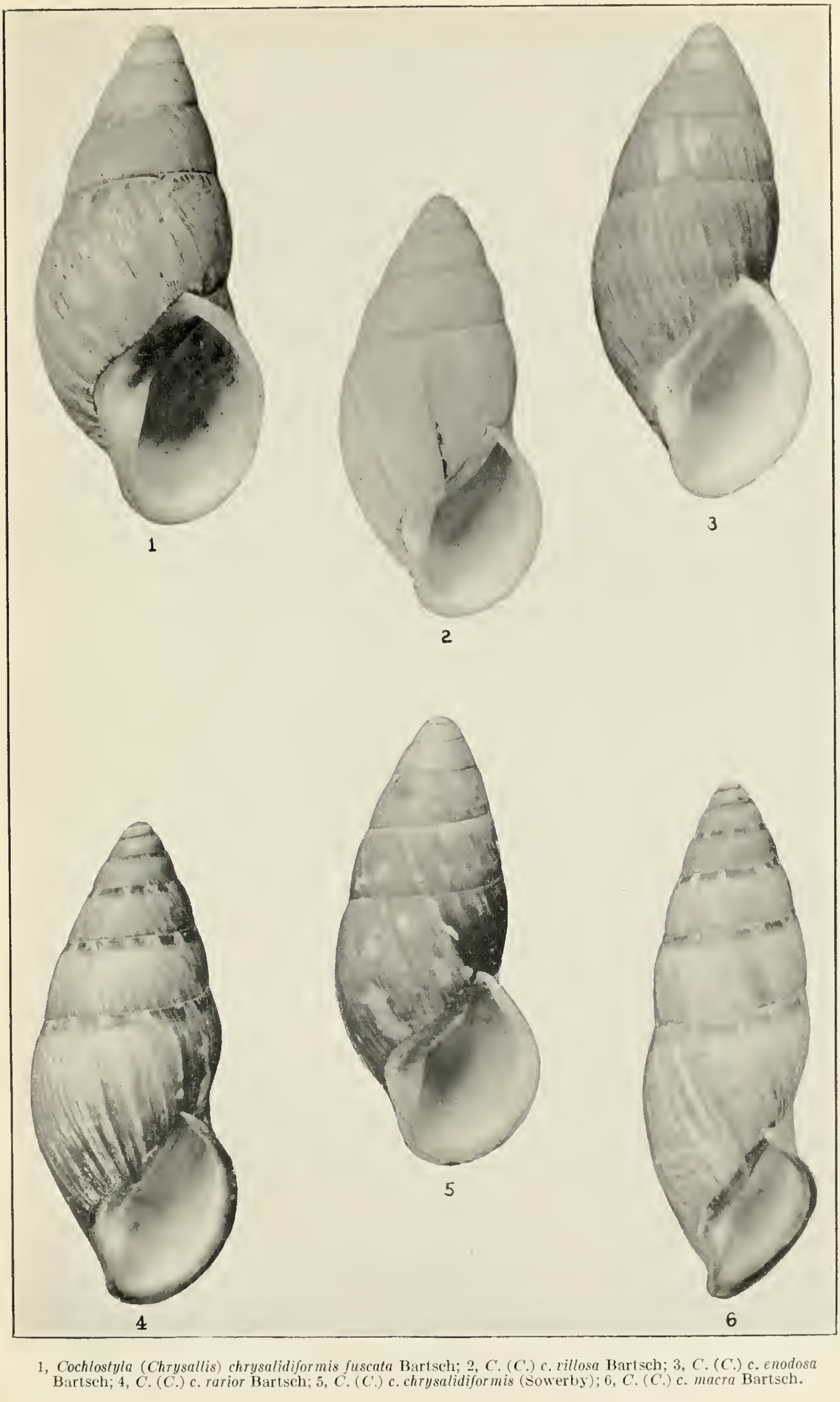
Mutations of *Cochlostyla* (*Prochilus*) *virgata* (Jay).


1
2
3
4
5
6
7
8
9
10
11
12

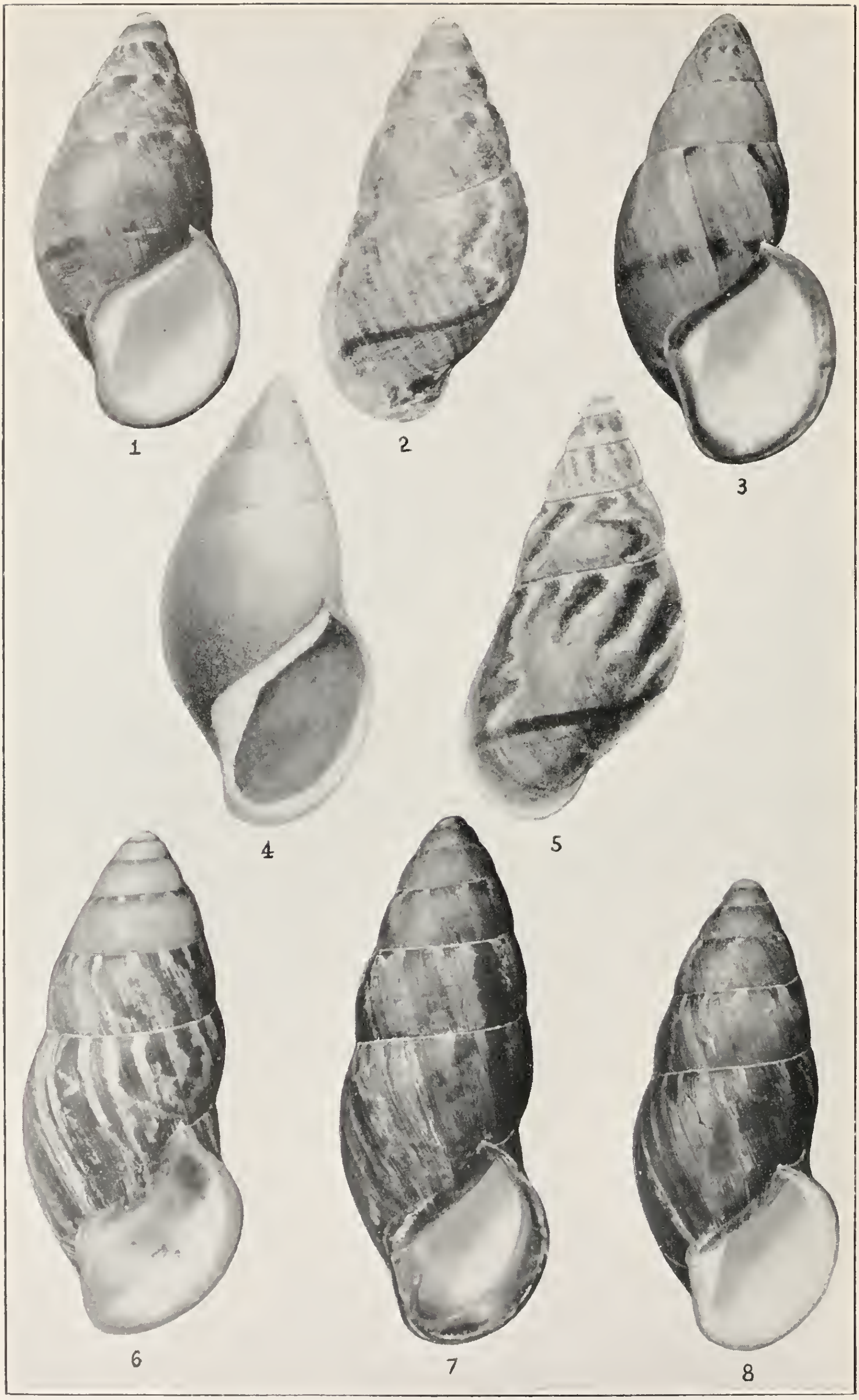
Range of variation in *Cochlostyla* (*Prochilus*) *partuloides* (Broderip).



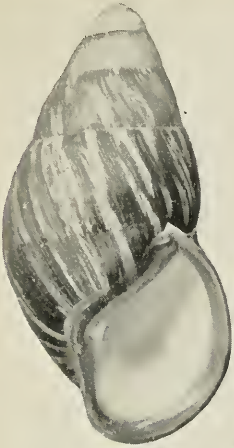
1, *Cochlostyla* (*Prochilus*) *fictilis fictilis* (Broderip) (copied from Sowerby); 2, *C.* (*P.*) *f. cagurana* Bartsch; 3, *C.* (*P.*) *f. ambulonensis* Bartsch; 4, *C.* (*P.*) *f. fictilis* (Broderip) (copied from Sowerby); 5, *C.* (*P.*) *cuyoensis contracta* Möllendorff; 6, 7, *C.* (*P.*) *fictilis fulva* Bartsch; 8, *C.* (*P.*) *cuyoensis subpallida* Bartsch; 9, *C.* (*P.*) *cerina* Bartsch; 10, *C.* (*P.*) *fictilis larvata* (Broderip) (copied from Sowerby); 11–16, *C.* (*P.*) sp.?



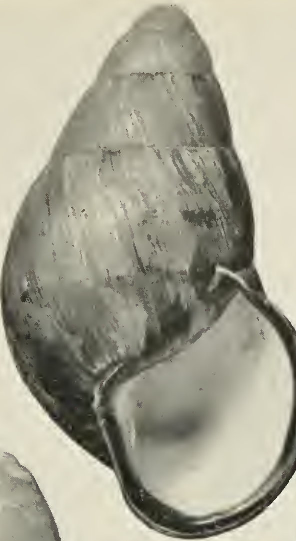
1, *Cochlostyla* (*Chrysallis*) *chrysalidiformis fuscata* Bartsch; 2, *C.* (*C.*) *c. villosa* Bartsch; 3, *C.* (*C.*) *c. enodosa* Bartsch; 4, *C.* (*C.*) *c. rarior* Bartsch; 5, *C.* (*C.*) *c. chrysalidiformis* (Sowerby); 6, *C.* (*C.*) *c. macra* Bartsch.



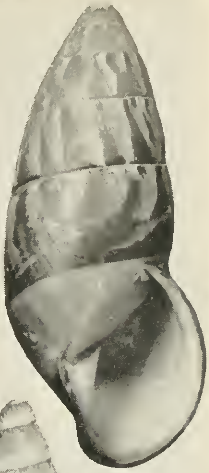
1, 2, *Cochlostyla* (*Chrysallis*) *electrica mangarina* Bartsch; 3, *C.* (*C.*) *e. bulalacaoana* Bartsch; 4. *C.* (*C.*) *petiti* Bartsch; 5, *C.* (*C.*) *electrica electrica* (Reeve) (copied from Reeve); 6, *C.* (*C.*) *jayi jayi* Bartsch; 7, *C.* (*C.*) *j. camorongana* Bartsch; 8, *C.* (*C.*) *j. perpusilla* Bartsch.



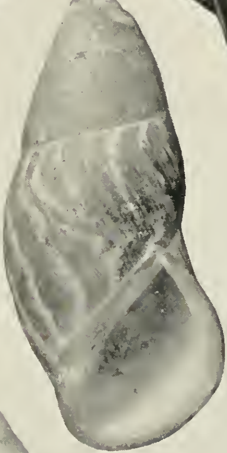
1



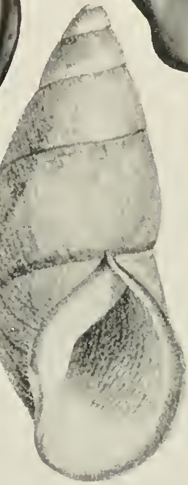
2



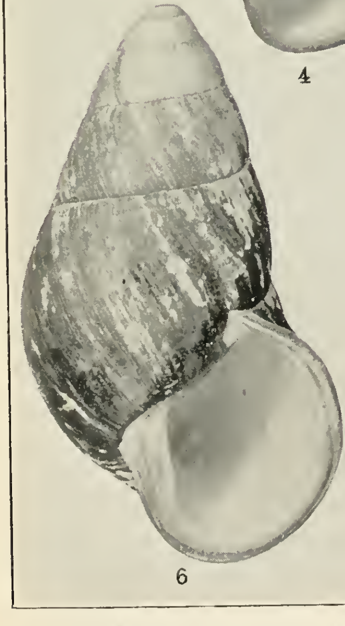
3



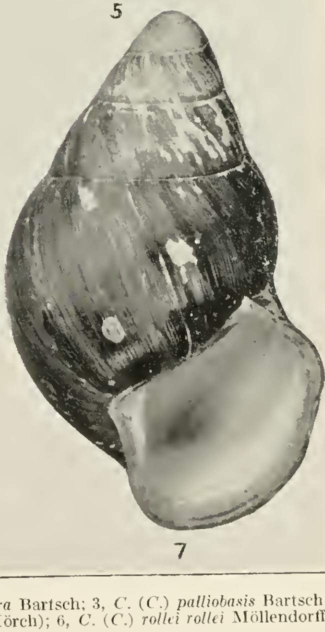
4



5

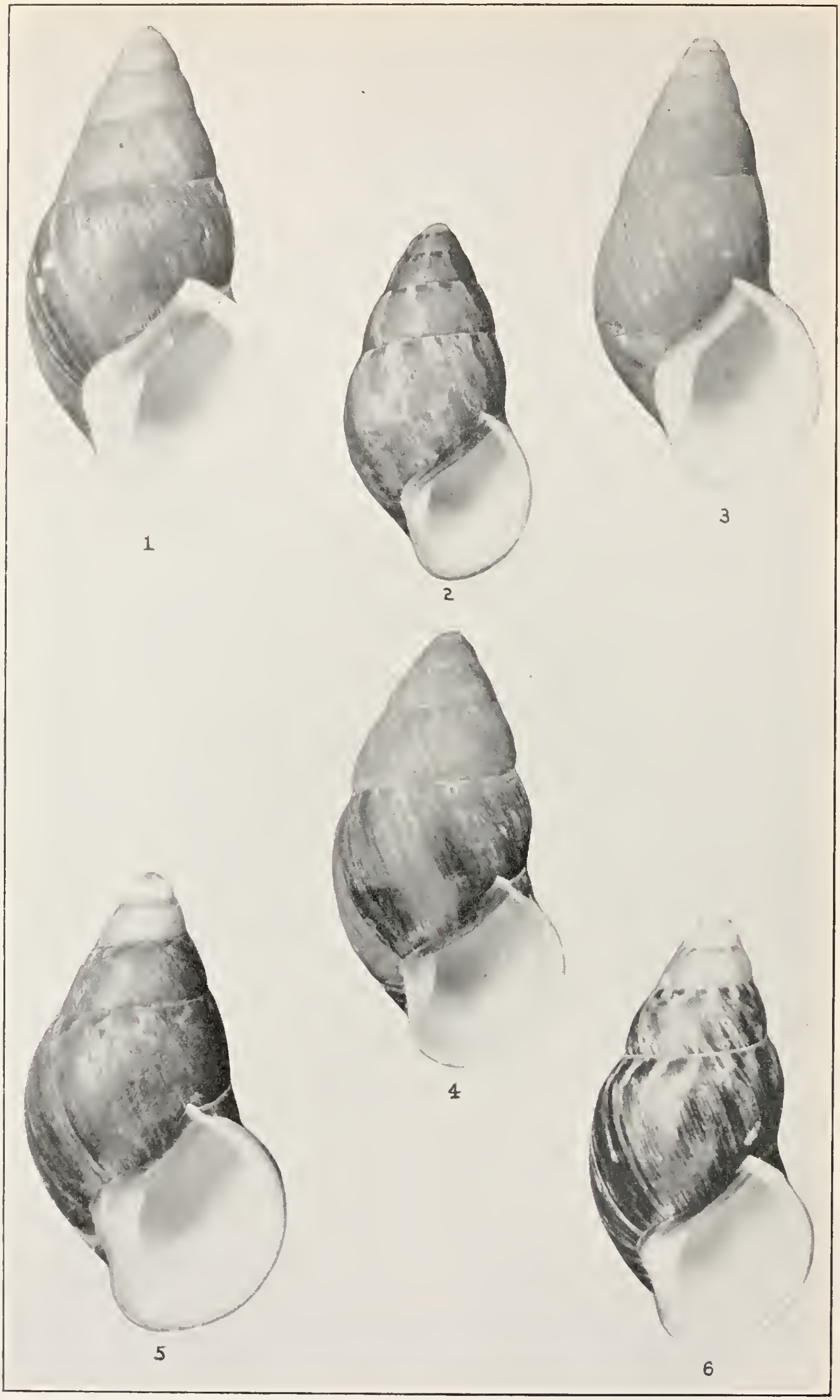


6

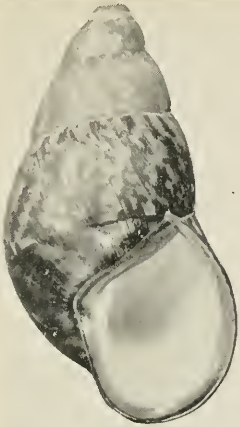


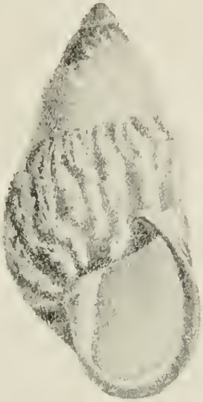
7

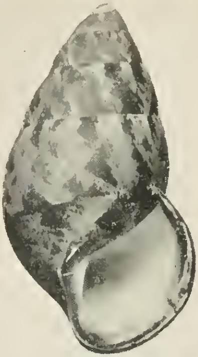
1, *Cochlostyla* (*Chrysallis*) *rollei vexator* Bartsch; 2, *C.* (*C.*) *r. nigra* Bartsch; 3, *C.* (*C.*) *palliobasis* Bartsch; 4, *C.* (*C.*) *lichenifer avittata* Bartsch; 5, *C.* (*C.*) *l. lichenifer* (Mörch); 6, *C.* (*C.*) *rollei rollei* Möllendorff; 7, *C.* (*C.*) *r. osborni* Bartsch.

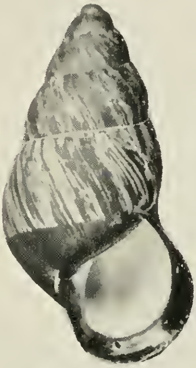


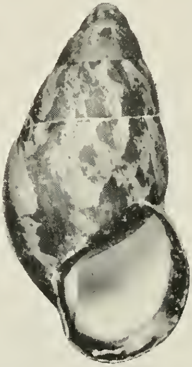
1, *Cochlostyla (Chrysallis) antoni antoni* Semper; 2, *C. (C.) a. macilenta* Bartsch; 3, *C. (C.) roseolabra rosea* Bartsch; 4, *C. (C.) r. roseolabra* Bartsch; 5, *C. (C.) albolabris robusta* Bartsch; 6, *C. (C.) a. albolabris* Bartsch.

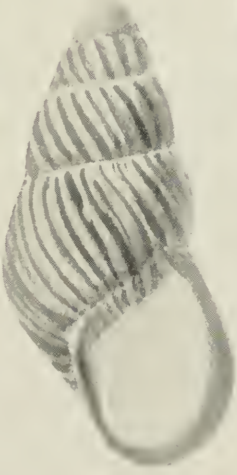

1

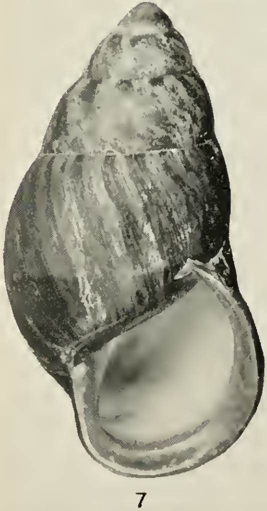

2

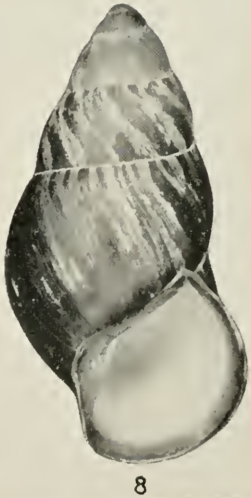

3


4

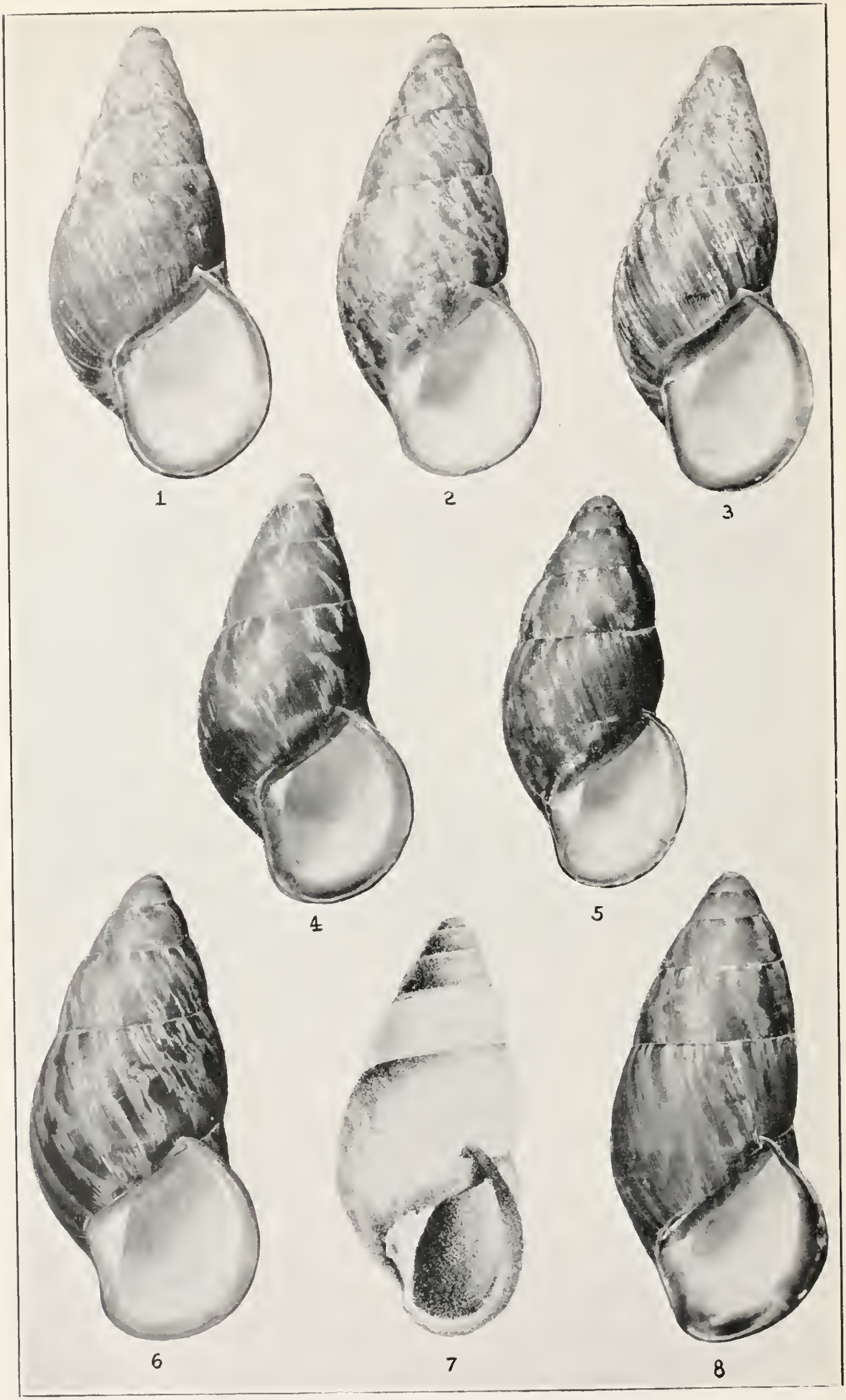

5


6

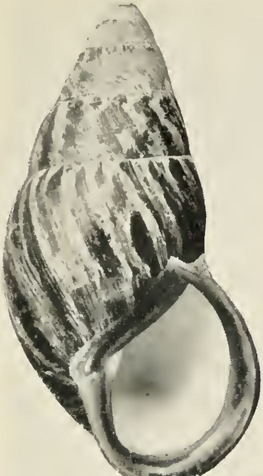

7


8

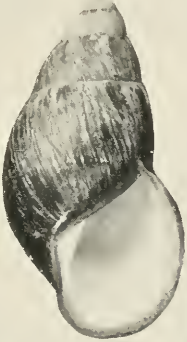
1, *Cochlostyla* (*Chrysallis*) *aspersa aspersa* (Grateloup); 2, *C.* (*C.*) *a. juani* Bartsch; 3, *C.* (*C.*) *a. aspersa* (copy); 4, *C.* (*C.*) *a. melanogaster* (Mörch); 5, *C.* (*C.*) *a. binuangana* Bartsch; 6, *C.* (*C.*) *a. mindoroensis* (Broderip) (copy); 7, *C.* (*C.*) *a. lunai* Bartsch; 8, *C.* (*C.*) *a. mindoroensis.*



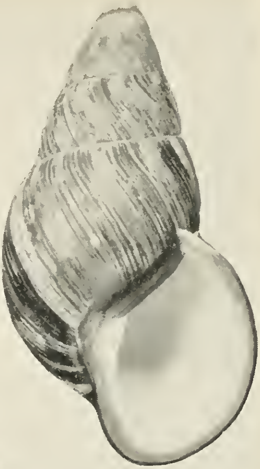
1, *Cochlostyla (Chrysallis) nigriceps nubifer* Bartsch; 2, *C. (C.) n. obnubila* Bartsch; 3, *C. (C.) n. nigriceps* Bartsch; 4, *C. (C.) aspersa wagneri* (Grateloup); 5, *C. (C.) a. calaritana* Bartsch; 6, *C. (C.) a. edgari* Bartsch; 7, *C. (C.) a. wagneri* (copy); 8, *C. (C.) a. ilogana* Bartsch.



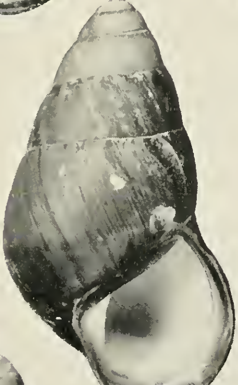
1



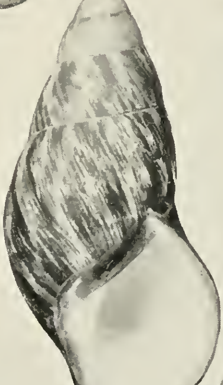
2



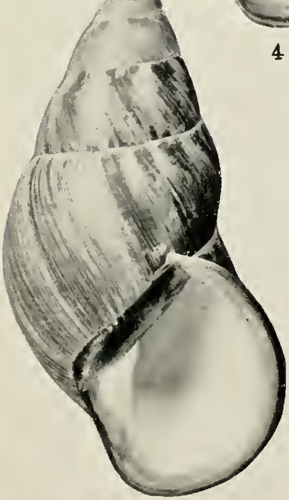
3



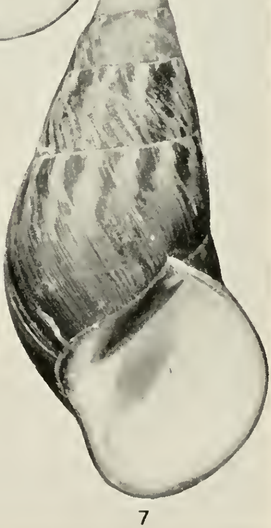
4



5

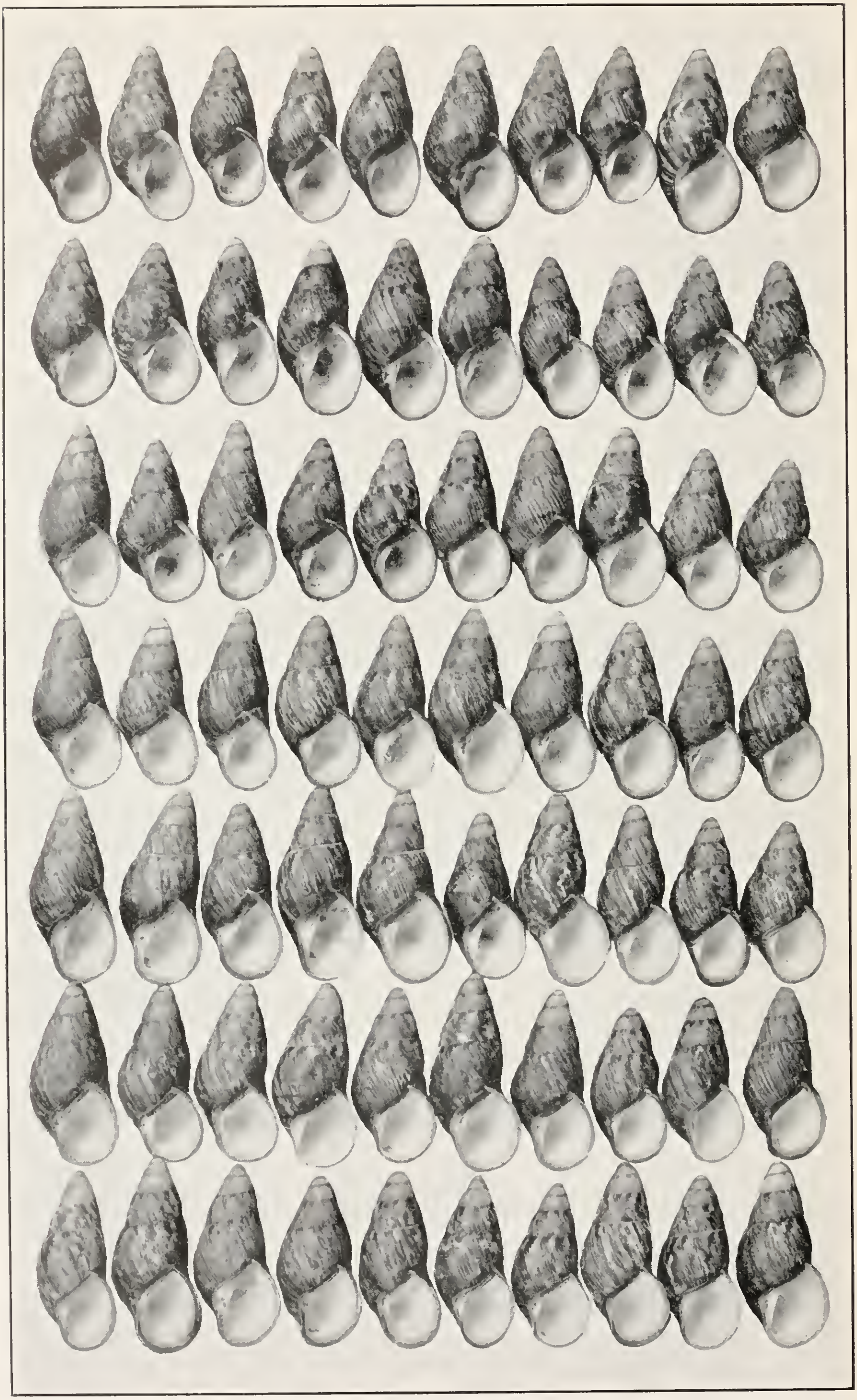


6

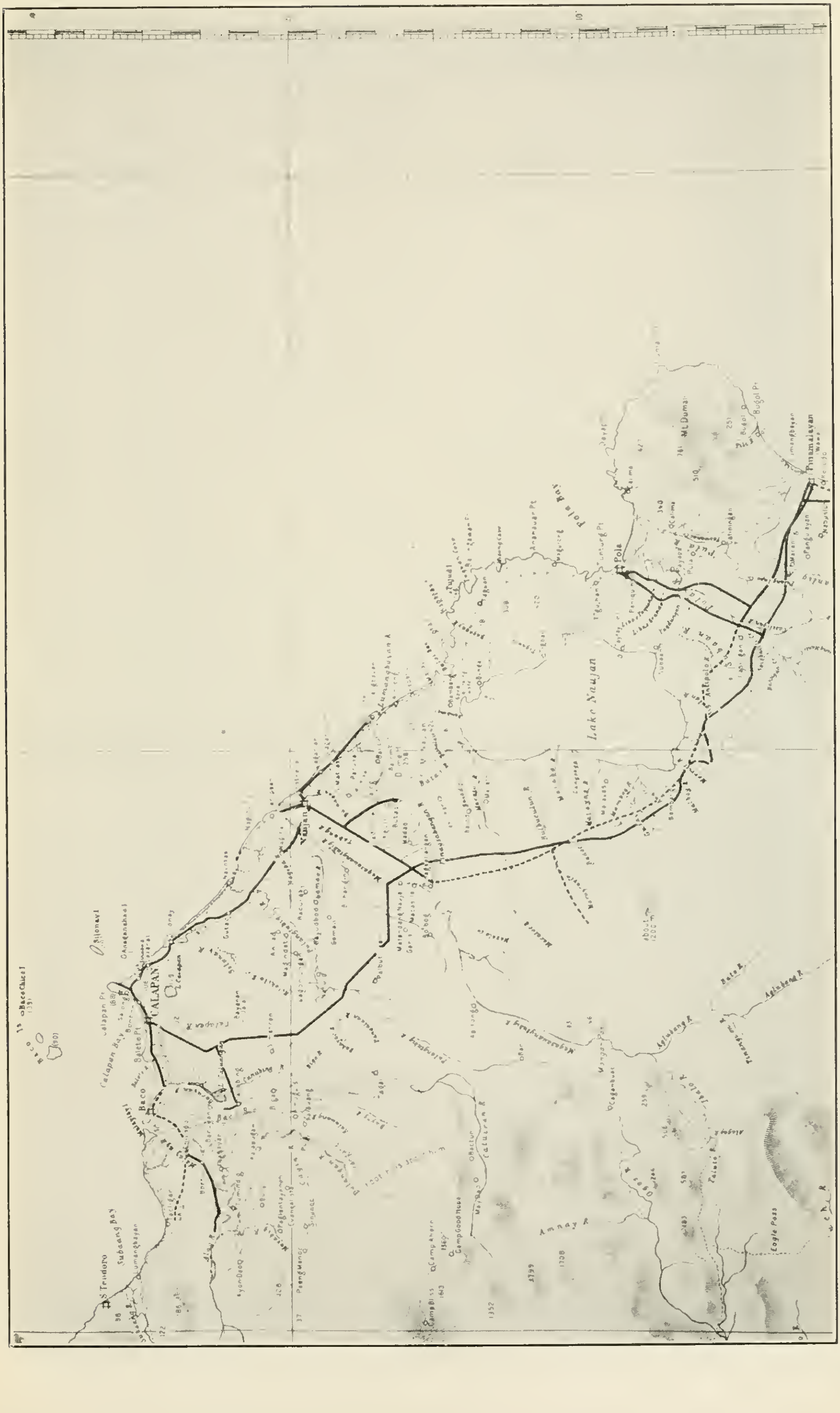


7

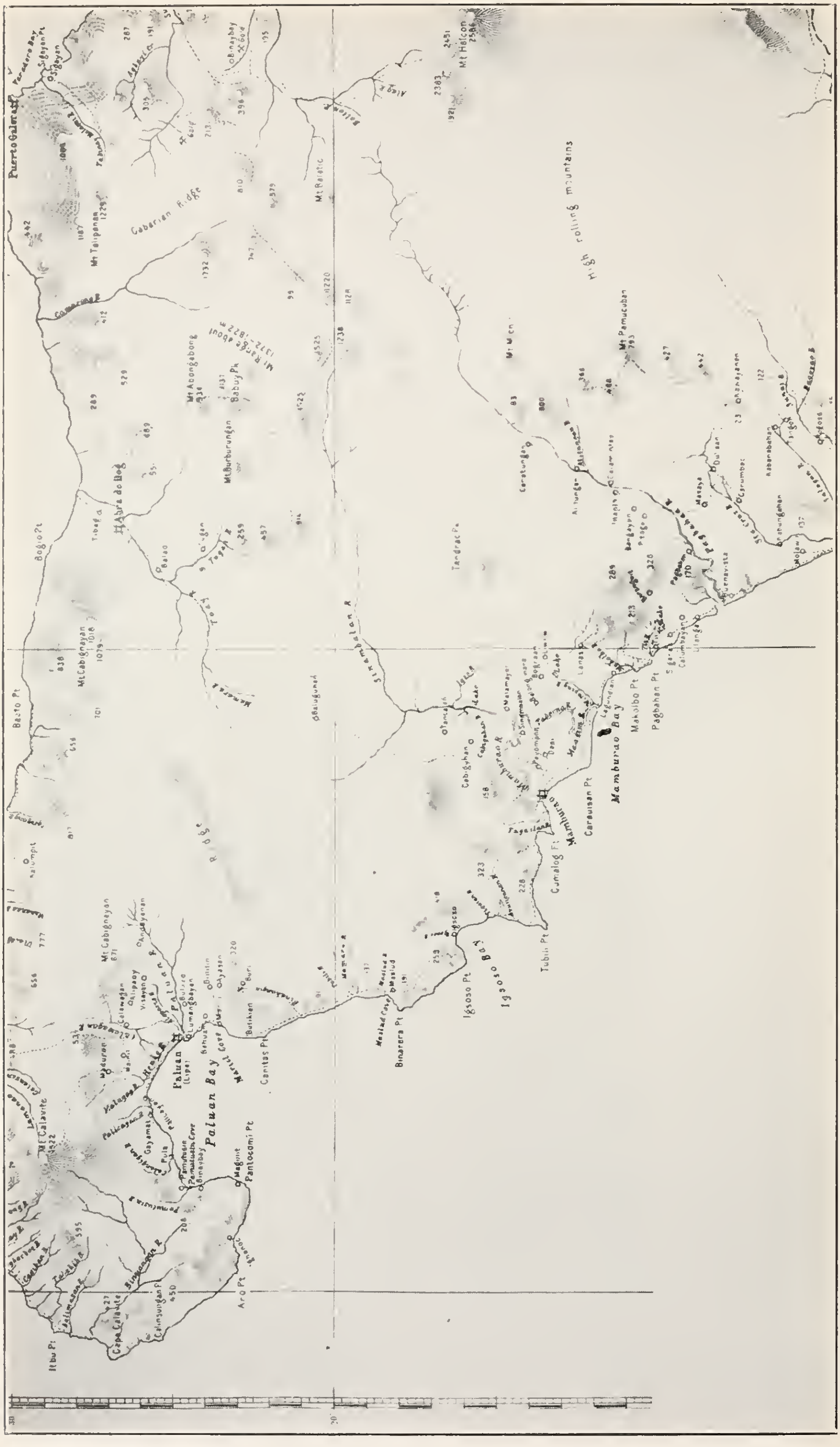
1, *Cochlostyla* (*Chrysallis*) *caniceps demesai* Bartsch; 2, *C.* (*C.*) *c. contracostana* Bartsch; 3, *C.* (*C.*) *c. minuta* Bartsch; 4, *C.* (*C.*) *perturbator* Bartsch; 5, *C.* (*C.*) *caniceps caniceps* Bartsch; 6, *C.* (*C.*) *c. conica* Bartsch; 7, *C.* (*C.*) *c. maita* Bartsch.



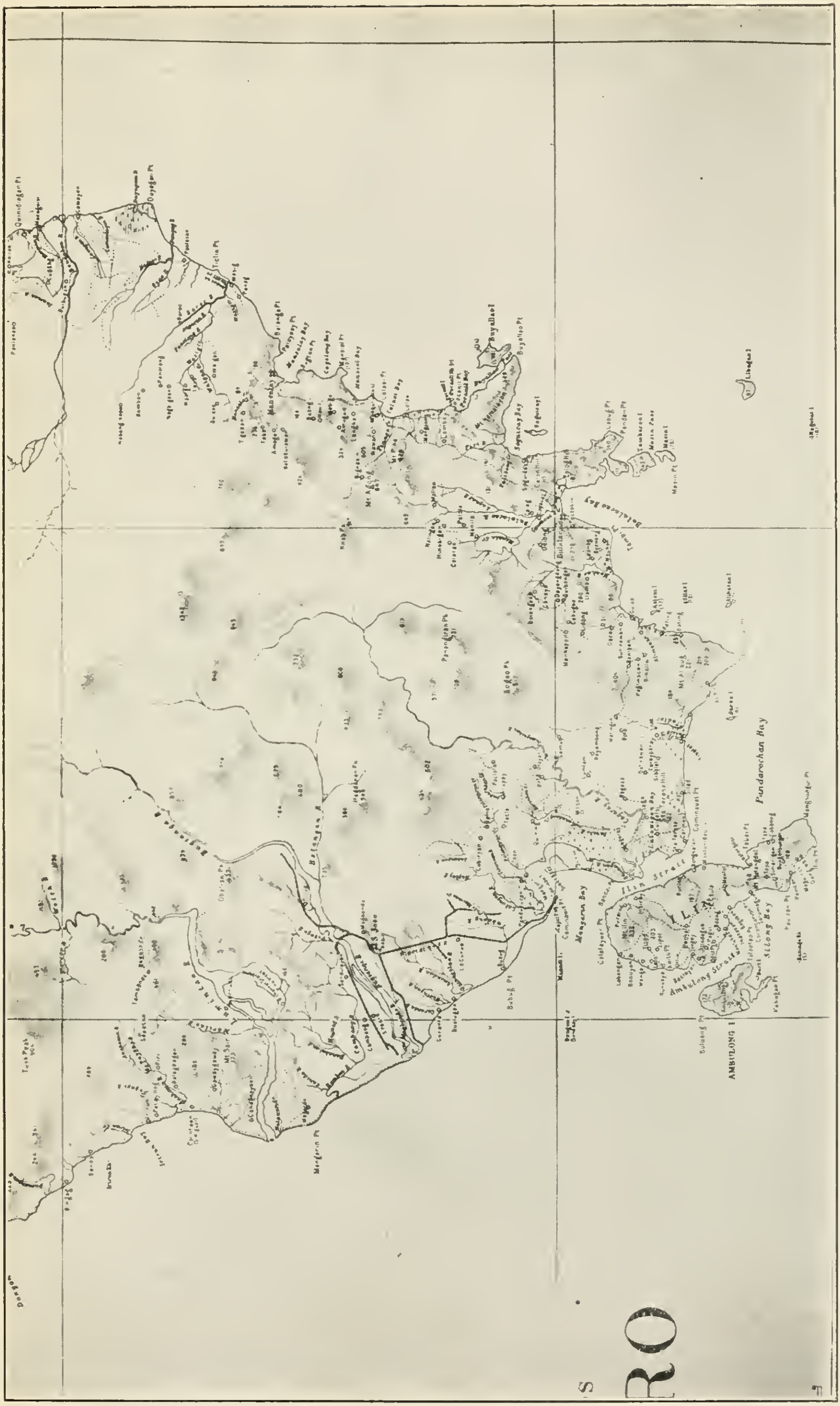
Seventy specimens of *Cochlostyla* (*Chrysallis*) *caniceps caniceps* Bartsch taken at random to show constancy of characters.


S. Teodoro
Subaang Bay
Lumangbayan
Baco
Calapan Bay
Calapan Pt.
CALAPAN
Silonay I.
Baco Chico I.
Naujan
Lumangbayan R.
Lake Naujan
Pola Bay
Pola
Mt. Dumali
Bugol Pt.
Pinamalayan
Amnay R.
Eagle Pass
Camp Bliss
Camp Good Hope
Calaucan R.

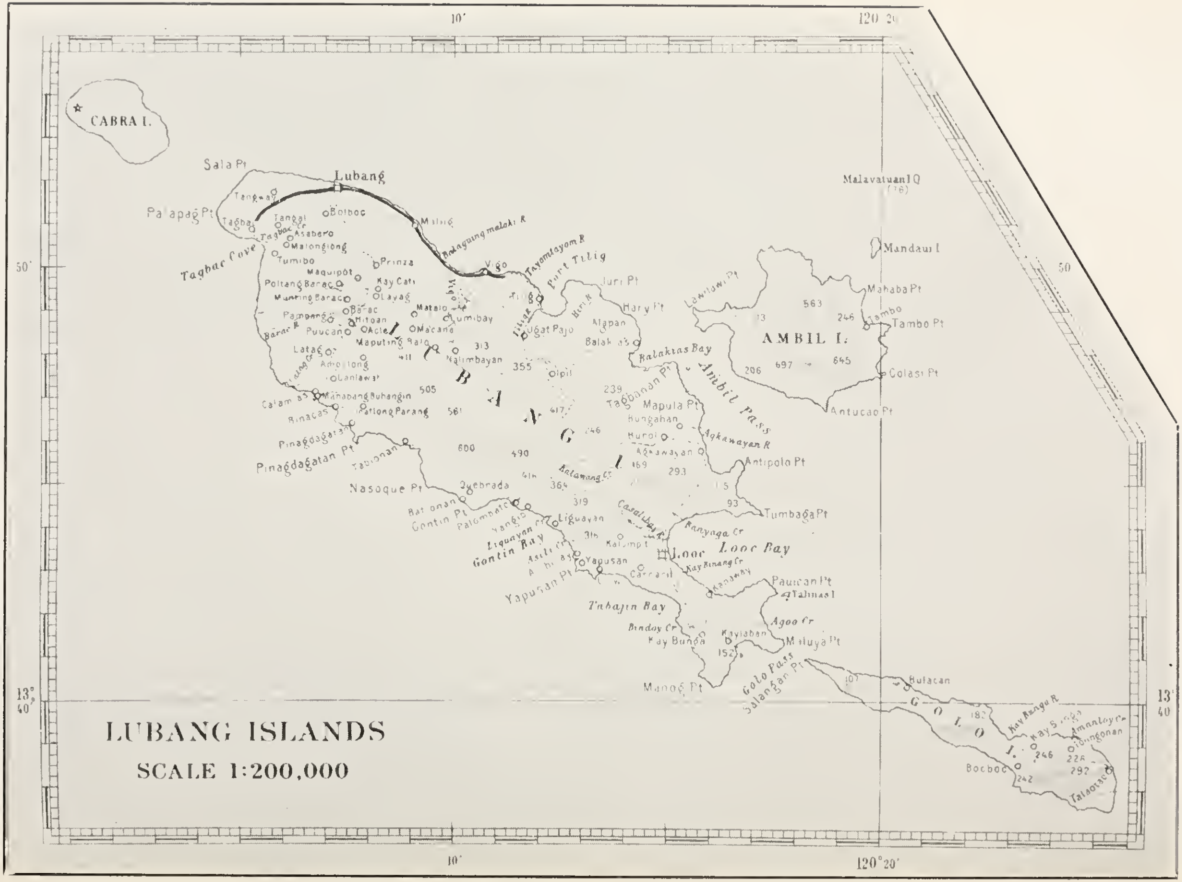
The northeastern portion of Mindoro. From Chart 10, Bureau of Coast and Geodetic Survey, Manila, 1929.


Puerto Galera
Varadero Bay
Mt Halcon
Mt Talipanan
Cabarian Ridge
Mt Baleteic
High rolling mountains
Mt Abongabong
Babuy Pk
Mt Burburungan
Abra de Ilog
Bagio Pt
Mt Cabigneyan
Baeto Pt
Mt Pamucuban
Mt Wen
Tandrac Pt
Mamburao Bay
Mamburao
Makolbo Pt
Pagbahan Pt
Caravisan Pt
Cumalog Pt
Tubili Pt
Igsoso Bay
Igsoso Pt
Binarara Pt
Canitas Pt
Paluan Bay
Paluan
Pantocomi Pt
Aro Pt
Mt Calavite
Cape Calavite
Ilbu Pt
Calinsungan Pt
Ridge

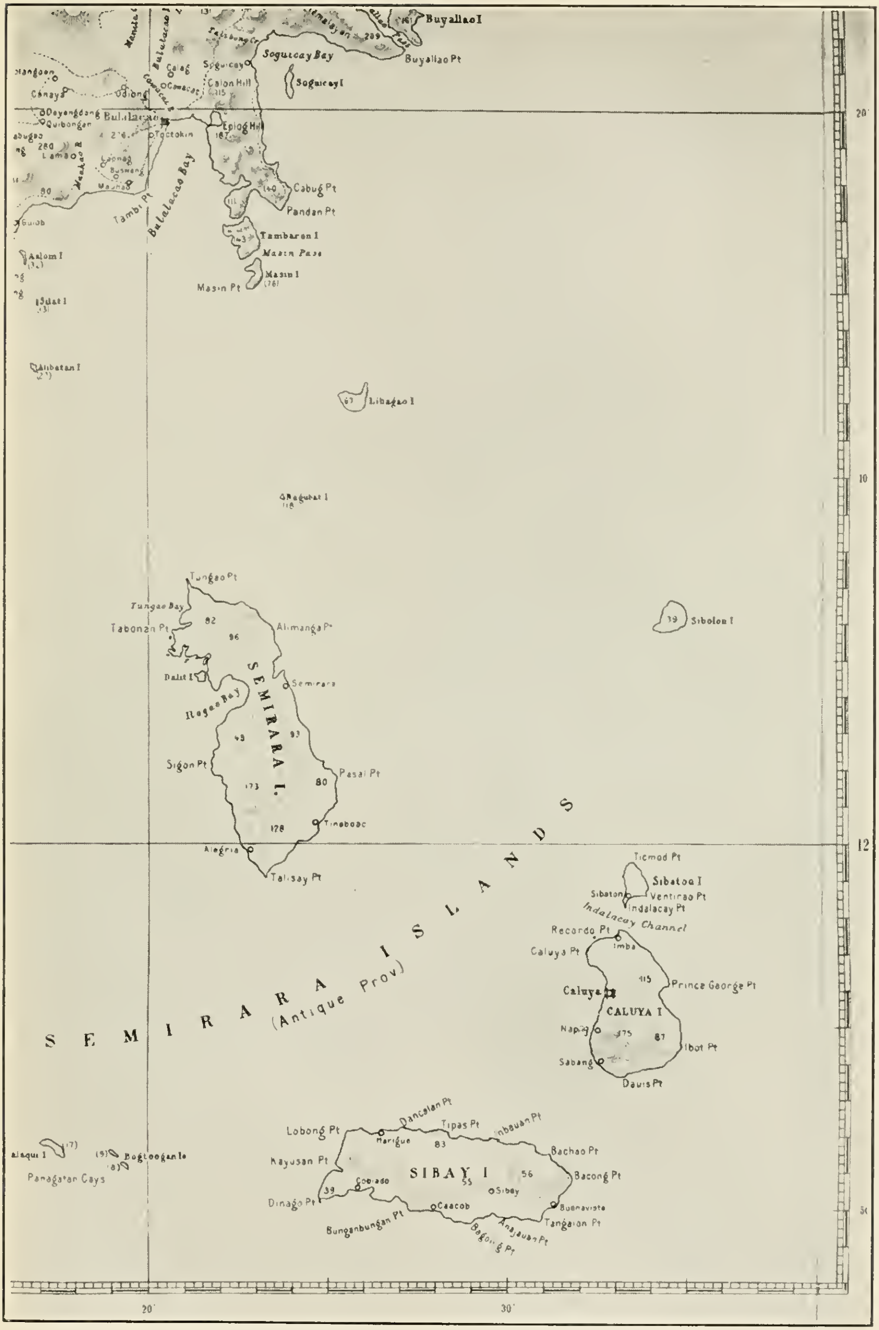
The northwestern portion of Mindoro. From same chart as Plate 116.


Bulalacao Bay
Pandarochan Bay
Ilin Strait
ILIN
Mangarin Bay
Ambulong Strait
Siloog Bay
AMBULONG I
Test Peak
RO
S

The southern portion of Mindoro. From same chart as Plate 116.


LUBANG ISLANDS
SCALE 1:200,000
CABRA I.
Sala Pt
Lubang
Palapag Pt
Tagbac Cove
Malig
Vigo
Port Tilig
Tayomtayom R
Juri Pt
Hary Pt
Balakias Bay
Ambil Pass
AMBIL I.
Malavatuan I
Mandaui I
Mahaba Pt
Tambo Pt
Colasi Pt
Antucao Pt
Antipolo Pt
Tumbaga Pt
Looc
Looc Bay
Paucan Pt
Agoo Cr
Maluya Pt
Tabajin Bay
Yapusan Pt
Gontin Bay
Gontin Pt
Nasoque Pt
Pinagdagatan Pt
Manog Pt
Golo Pass
Salangan Pt
GOLO I.
Bulacan
Bocboc
Talaotao
LUBANG I.
10'
120°20'
50'
13°40'

The islands northwest of Mindoro. From the same chart as Plate 116.


Buyallao I
Buyallao Pt
Soguicay Bay
Soguicay
Soguicay I
Calon Hill
215
Calag
Comacat
Bulalacao
Odiong
Canays
Dayangdang
Quibongan
Toctokin
Lamao
Lapnag
Buswang
Mauhao
Tambi Pt
Bulalacao Bay
Epiog Hill
167
Cabug Pt
Pandan Pt
Tambaron I
Masin Pass
Masin I
(76)
Masin Pt
Guiob
Aslom I
Isdat I
Alibatan I
Libagao I
Nagubat I
118
Tungao Pt
Tungao Bay
Tabonan Pt
Alimanga Pt
Dalit I
Semirara
SEMIRARA I.
Nogas Bay
Sigon Pt
Pasal Pt
Tinoboac
Alegria
Talisay Pt
Sibolon I
SEMIRARA ISLANDS
(Antique Prov)
Tiemod Pt
Sibato I
Sibaton
Ventirao Pt
Indalacay Pt
Indalacay Channel
Recordo Pt
Imba
Caluya Pt
Caluya
CALUYA I
Prince George Pt
Napisa
Sabang
Ibot Pt
Davis Pt
Lobong Pt
Harigue
Dancalan Pt
Tipas Pt
Inbauan Pt
Bachao Pt
Kayusan Pt
SIBAY I
Cobrado
Sibay
Bacong Pt
Dinago Pt
Caacob
Buenavista
Tangaran Pt
Bungsnbungan Pt
Bagong Pt
Anajauan Pt
Alaqui I
Bogtoogan Is
Panagatan Cays
20'
10
12
20'
30'

The islands southeast of Mindoro. From the same chart as Plate 116.

INDEX

aberrans, Dictyocladium, 195, 199, 214, 241.
abjecta, Biddulphia, 33, 177.
abrupta, Navicula, 94.
Acanthella effusa, 199, 229, 241.
Acavus (Tachea) decorus, 430.
Achatina cincinniformis, 440.
Achnanthes, 10, 11, 60, 143, 175.
    baldjikii, 12.
    brevipes, 11.
    cocconeiformis, 10, 176.
    compacta, 10, 176.
    crenulata, 11.
    danica, 12.
    exigua, 12.
    flahaulti, 11.
    heteromorpha, 11, 60.
    hexagona, 11.
    inflata, 11.
    lanceolata, 11.
    longipes, 10, 11.
    pennaeformis, 175.
    subsessilis, 11.
    tenuistauros, 11, 176.
    ventricosa, 11.
Achnanthidium danicum, 12.
    javanica, 12.
achnanthioides, Mastogloia, 87, 178.
Achnathes mammalis, 61.
Acoetes magnifica, 315.
Acoetidae, 186.
acrosphaeria, Navicula, 94.
Acryptolaria, 210.
    normani, 199, 208, 209, 241.
    pulchella, 199, 210.
Actinocyclus, 12, 13, 58, 70, 146, 175.
    bipartitus, 12, 176.
    curvatulus, 12.
    decussatus, 12, 176.
    ehrenbergii, 165.
    nebulosus, 12, 13.
    obscurus, 13.
    pruinosus, 13.
    punctulatus, 12, 13.
    rotula, 13.
    sparsus, 12, 13.
    splendens, 13.
    stictodiscus, 13, 146.
    subtilis, 13.
Actinodiscus, 13, 29, 79.
    barbadensis, 14.
    grayii, 14.
    horologium, 29.
    schleinitzii, 13.
Actinoptychus, 13, 14.
    amblyceros, 14.
    annulatus, 14, 15.
    areolatus, 14.
Actinoptychus biseptinarius, 15.
    hexagonus, 14.
    hispidus, 14.
    janischii, 14.
    laevigatus, 15.
    moelleri, 15.
    parvus, 15, 176.
    splendens, 15.
    subangulatus, 15.
    tenarius, 15.
    trilingulatus, 14, 15.
    undulatus, 14, 15.
aculeata, Stephanopyxis, 145.
acus, Glyphodesmis, 78, 178.
    Pleurosigma, 132, 181.
acutispina, Histocidaris, 247, 248–249 (fig.), 307, 310.
adeei, Anisodiscus, 28, 176.
admirabilis, Stoschia, 70, 150, 151.
adonis, Navicula, 122.
adornatus, Campylodiscus, 8, 48.
adriatica, Podocystis, 140.
adriaticum, Rhabdonema, 141.
adriaticus, Campylodiscus, 48.
adspersa, Chrysallis, 505.
aegrota, Cochlostyla, 380, 381.
    Cochlostyla (Corasia), 380.
    Corasia, 380.
    Helicostyla, 381.
    Helix, 380, 381.
    Helix (Corasia), 380.
aestiva, Navicula, 94, 106, 120, 121.
affine, Chaetoceros, 56.
    Pleurosigma, 133, 136.
affinis, Stictodiscus, 149.
affirmata, Mastogloia, 87.
    Navicula, 92.
africanus, Coscinodiscus, 64.
Aglaophenia, 226, 231, 237.
    calycifera, 199, 231, 237.
    cupressina, 231.
    divaricata, 199, 232.
    macgillivrayi, 199, 231.
    mccoyi, 232.
    philippina, 235.
    phoeniceus, 233.
    ramosa, 232.
    (Lytocarpia) secunda, 234.
    triramosa, 199, 219, 232, 242.
    urens, 199, 232, 235.
Aglaopheninae, 197.
aglaophenoides, Plumularia, 199, 222, 224, 241.
alampe, Cochlostyla virgata, 457.
alata, Amphora, 8, 17.
    Nitzschia, 125, 126.
albersi, Bulimus, 448.
    Cochlodryas, 448.

albifrons, Mastogloia, 90.
albina, Cochlostyla, 451.
    Cochlostyla (Eudoxus), 451.
albinus, Bulimus, 451.
albolabris, Cochlostyla (Chrysallis), 492, 493.
    Cochlostyla (Chrysallis) albolabris, 493, 494.
Alloioneis, 94.
    grundleri, 105.
Allonitzschia, 16.
    munifica, 16, 176.
alternata, Amphora, 18, 176.
ambigua, Navicula, 89.
ambiguus, Campylodiscus, 48, 52.
amblyceros, Actinoptychus, 14.
ambulonensis, Cochlostyla (Prochilus) fictilis, 467, 468.
americana, Podocystis, 140.
americanum, Syringidium, 160.
amoenus, Aulacodiscus, 32.
Ampelita, 378.
amphiceros, Rhaphoneis, 142.
Amphidromus, 378, 500.
    calobapta, 456.
    calobaptus, 456.
    cincinniformis, 440, 441.
    quadrasi, 500.
    versicolor, 500.
    virgatus, 456.
Amphipentas, 34, 165.
    campechiana, 34.
    godeffroyi, 34.
    quinquelobata, 34.
Amphiprora, 16, 17, 26, 173.
    limpida, 16, 176.
    membranacea, 173.
    o'swaldii, 17, 176.
    paludosa, 17.
    pelagica, 17.
    plicata, 17.
    temperei, 17.
Amphitetras, 34, 165.
    graeffeiana, 164.
Amphora, 2, 17, 20, 26.
    alata, 8, 17.
    alternata, 18, 176.
    anceps, 18, 176.
    angusta, 18, 21.
    arcuata, 18.
    arenaria, 19.
    areolata, 27.
    biconvexa, 19.
    bigibba, 19.
    camelus, 19, 28.
    clara, 19.
    clathrata, 19, 176.
    compacta, 19, 176.
    corpulenta, 18, 20.
    costata, 20, 21.
    crassa, 8, 20.
    crassa campechiana, 7, 20.
    cucumeris, 20, 176.
    cymbelloides, 18.
    cymbifera, 20, 21.
    delphinia, 22.
    dichotoma, 21, 176.
    diducta, 21.
Amphora dorsalis, 28.
    dromas, 19.
    dura, 22, 176.
    egregia, 8, 19, 22.
    erebi, 21.
    exsecta, 8, 22.
    flexa, 22, 176.
    formosa, 8, 23.
    furcata, 8, 23.
    fusca, 8, 23.
    gibba, 8, 23.
    gigantea, 8, 23.
    graeffei, 23.
    grevilleana, 23.
    grundleri, 8, 23.
    henshawii, 23, 176.
    honshuensis, 25.
    hyalina, 24.
    inflata, 8, 24.
    interrupta, 24.
    intersecta, 24, 176.
    labuensis, 27.
    lineata, 24.
    lineata constricta, 24.
    lunaris, 24, 176.
    magnifica, 25, 176.
    milesiana, 25.
    monilifera, 25.
    nodosa, 25, 176.
    obesa, 25.
    obtusa, 22, 25.
    obtusa oceanica, 25.
    ocellata, 25.
    ocellata cingulata, 25.
    oculus, 25.
    ostrearia vitrea, 25.
    ovalis, 25.
    pauca, 25, 176.
    pecten, 26.
    pellucida, 27.
    permagna, 26.
    philippinica, 24.
    polyzonata, 26.
    praevalida, 19, 26.
    prismatica, 26.
    proteus, 26, 27.
    pulchra, 26, 176.
    recessa, 27, 176.
    rectangularis, 27.
    rhombica, 27.
    sarniensis, 28.
    scabriuscula, 22.
    scalaris, 26.
    schmidtii, 8, 27.
    sima, 27, 176.
    sinuata, 28.
    spectabilis, 21, 23.
    spectabilsi, 6.
    terroris, 21.
    tetragibba, 28.
    tumulifer, 28, 176.
    turgida, 28.
    virgata, 24.
    weissflogii, 28.
Amphoropsis, 173.
anceps, Amphora, 18, 176.
    Campylodiscus, 49, 158.
    Stictodiscus, 166.

Angara, Antonio, 375.
angulata, Mastogloia, 87.
angulatum, Pleurosigma, 9, 132–134, 136, 137, 139.
angulatus, Pseudo-Stictodiscus, 168.
angulosa, Navicula, 94.
angusta, Amphora, 18, 21.
angustata, Fragilaria, 77.
Anisodiscus, 28.
  adeei, 28, 176.
Annelids, polychaetous, 183, 313.
Annulariidae, 323.
annulatum, Triceratium, 14.
annulatus, Actinoptychus, 14, 15.
annulifera, Cidaris, 257.
  Cidarites, 259.
  Leiocidaris pistillaris, 257.
  Phyllacanthus, 257, 258.
  Prionocidaris baculosa, 257, 259, 307.
annulosa, Stylocidaris, 294 (fig.), 296, 298 (fig.), 308–310, 312.
annulus, Hyalodiscus, 83, 178.
antarcticum, Trigonium, 164.
Antennella biarmata, 199, 226, 241.
  recta, 199, 227, 241.
Antennopsis, 228, 230.
  pacifica, 199, 228, 241.
antillarum, Biddulphia, 8, 34.
  Navicula, 94.
  Plagiogramma, 129, 181.
antipolana, Cochlostyla rufogaster, 332–334.
Antomma, 197.
antoni(i), Cochlostyla, 495, 496.
  Cochlostyla (Chrysallis), 494, 495.
  Cochlostyla (Chrysallis) antoni, 495, 496.
  Cochlostyla chrysalidiformis, 495.
  Helicostyla chrysalidiformis, 495.
aopta, Cochlostyla (Calocochlea), 381, 385.
  Helicostyla (Calocochlea), 385.
Aphroditidae, 183.
apiae, Surirella, 155.
apiculata, Cocconeis, 60, 61.
  Pinnularia, 103.
  Stauroneis, 61.
apollinis, Coscinodiscus, 64.
Aporocidaris, 244, 283, 285.
appendiculata, Stephanopyxis, 145.
approximata, Navicula, 7, 8, 94, 104.
  Tropidoneis, 173.
approximatum, Plagiogramma, 129, 131.
arachne, Asteromphalus, 29.
Arachnoidiscus, 9, 29, 146, 168.
  ehrenbergii, 29.
arctica, Biddulphia balaena, 166.
  Navicula, 96.
arcticum, Trigonium, 34, 161, 164, 166, 169, 171.
arctium, Trigonium, 161.
arcuata, Amphora, 18.
  Euodia, 80.
arcuatum, Rhabdonema, 141.
Ardissonia, 159, 160.
arenaria, Amphora, 19.
areolata, Amphora, 27.
areolatum, Triceratium, 40.
areolatus, Actinoptychus, 14.
  Asteromphalus, 30, 176.
argus, Campyloneis, 55.
  Hyalodiscus, 83.
  Stictodiscus, 149.
armata, Stechowia, 199, 230, 242.
armatum, Triceratium, 46.
aspera, Navicula, 95.
  Orthosira, 90.
aspersa, Bulimus, 501, 504.
  Cochlostyla, 505.
  Cochlostyla (Chrysallis), 501, 503, 504, 526.
  Cochlostyla (Chrysallis) aspersa, 503, 504, 514.
aspersus, Bulimus, 504, 505.
  Hyalodiscus, 83, 178.
assimilis, Schizocidaris, 276, 279, 280.
Asterolampra, 29.
  marylandica, 29.
  princeps, 29.
  van huerckii, 29.
asteromphalus, Coscinodiscus, 65, 95.
Asteromphalus, 29.
  arachne, 29.
  areolatus, 30, 176.
  beaumontii, 30.
  brookei, 30.
  elegans, 30.
  hiltonianus, 30.
  reticulatus, 30.
  robustus, 30.
  roperianus, 30.
asymmetrica, Plumularia, 226.
atomus, Plagiogramma, 130.
attenuatum, Eudendrium, 202.
  Plagiogramma, 129, 181.
Aulacodiscus, 9, 14, 31, 40.
  amoenus, 32.
  kinkeri, 31.
  kittonii, 40.
  macraeanus, 31.
  margaritaceus, 31.
  oregonus, 31.
  oregonus sparsus-punctata, 31.
  orientalis, 31.
  pretiosus, 31, 176.
  recedens, 31, 176.
  voluta coeli, 31.
Auliscus, 32, 43.
  caelatus, 32.
  caelatus delicatula, 32.
  caelatus latecostata, 7, 32.
  compositus, 32.
  hardmanianus, 32.
  oamaruensis madagascarensis, 32.
  philippinarum, 32, 176.
  quadratus, 33, 177.
  reticulatus, 33.
  schmidtii, 33.
  stockhardtii, 33.
aureola, Cochlostyla (Cochlodryas) florida, 411, 414.
Auricula, 26, 33, 173.
  insecta, 33.
  japonica, 33.
  ostrea, 33.

auriculata, Helix, 345, 361.
aurita, Biddulphia, 34.
australica, Podocystis, 140.
australis, Omphalopsis, 129.
  Stictodesmis, 147.
avittata, Cochlostyla (Chrysallis) lichenifer, 480, 481.
bacteriastrum, Chaetoceros, 57.
Bacteriastrum, 55, 57.
  furcatum, 58.
  hyalinum, 57.
  varians, 56, 57.
  varians princeps, 57.
  wallichii, 57.
baculosa, Cidaris (Cidaris), 257.
  Prionocidaris, 258.
balaena, Biddulphia, 34, 81.
  Trigonium, 34, 161, 170.
baldjikii, Achnanthes, 12.
balearica, Biddulphia, 34.
balei, Lytocarpus, 199, 236.
  Thecocarpus, 199, 236, 242.
balticum, Pleurosigma, 132, 133, 138.
banahaoana, Cochlostyla rufogaster, 336.
barbadense, Skeletonema, 145.
barbadensis, Actinodiscus, 14.
  Heibergia, 166.
barbitos, Navicula, 95.
barthelowi, Obba gallinula, 343.
bartholomei, Navicula, 100.
Bartsch, Paul, on Cochlostyla rufogaster and Obba marmorata and their races, 329.
  on Cochlostyla of Mindoro Province, 373.
  on land shells of the genus Obba from Mindoro Province, 343.
  on land shells of the genus Opisthoporus, 323.
bartschi, Cochlostyla (Calocochlea) roissyana, 387, 388, 393.
  Helicostyla (Calocochlea) roissyana, 388.
beaumontii, Asteromphalus, 30.
belgica, Navicula, 123.
bellus, Campylodiscus, 49.
benguetana, Cochlostyla rufogaster, 330.
  Obba marmorata, 338, 339.
bertillonii, Surirella, 151, 181.
beyrichiana, Navicula, 95.
biangulatus, Campylodiscus, 49.
  Coscinodiscus, 65, 95.
biarmata, Antennella, 199, 226, 241.
biciliatus, Opisthoporus, 323, 327.
biclavata, Navicula, 95.
biconvexa, Amphora, 19.
bicorne, Triceratium, 38.
bicornis, Biddulphia, 34.
bicoronatum, Stictodiscus, 167.
  Trigonium, 149, 161, 165, 169, 182.
bicoronatus, Stictodiscus, 166–168.
Biddulphia, 2, 33, 35, 36, 39, 40, 42, 44, 81, 161, 164, 168, 171.
  abjecta, 33, 177.
  antillarum, 8, 34.
  aurita, 34.
  balaena, 34, 81.
Biddulphia balaena arctica, 166.
  balearica, 34.
  bicornis, 34.
  birostrum, 34.
  broeckii, 35.
  (Triceratium) broeckii, 38.
  brookei, 35.
  campechiana, 8, 35.
  castellifera, 35.
  chinensis, 42.
  cingulata, 35, 36, 177.
  concava, 35.
  consimilis, 36.
  cornigera, 36, 39, 177.
  cornuta, 37.
  culcitella, 37.
  cuspidata, 37.
  cycloides, 37, 177.
  discursa, 37, 177.
  distincta, 38.
  dubia, 38.
  elegans, 8.
  exacta, 38, 177.
  expedita, 36, 39.
  favus, 37–39, 46, 165.
  fimbriata, 39.
  fractosa, 39, 177.
  gemina, 40.
  gibbosa, 40.
  grundleri, 40.
  grunowiana, 40.
  heteroceros, 40, 44.
  impressa, 40.
  indica, 41.
  (Triceratium) inelegans, 42.
  informis, 41, 177.
  insignis, 41.
  interrupta, 44.
  inversa, 41, 177.
  japonica, 35.
  juncatensis, 7, 42.
  juncta, 42.
  madagascarensis, 42.
  membranacea, 42.
  mobiliensis, 42.
  oamaruensis, 36.
  papillata, 43.
  pentacrinus, 43, 45.
  pentecrinus, 8.
  petitiana, 43, 177.
  petitii, 43, 44, 177.
  polymorpha, 58.
  pulchella, 44, 80, 81.
  punctata, 44, 48.
  pygmaea, 44.
  radiata, 44.
  reticulata, 38, 45.
  reticulata subspinosa, 45.
  retiformis, 45, 177.
  robertsiana, 45.
  roperiana, 45.
  rudis, 45, 177.
  schmidtii, 46.
  scitula, 8, 39, 46.
  (Triceratium) scitula, 35.
  (Triceratium) scitulum, 38.
  secedens, 46.
  setigera, 46.

Biddulphia spinulosa, 46.
  stokesiana, 46.
  tabellaria, 46.
  (Triceratium) tabellarium, 39.
  temperei, 46.
  titiana, 170
  tripos, 46.
  trisinua, 47, 177.
  tumescens, 47.
  tuomeyi, 47.
  turgida, 47.
  turrigera, 47, 177.
  undulosa, 48, 177.
Biddulphiae, 36, 40.
biformis, Navicula, 95, 179.
bigemmata, Navicula, 95, 107, 179.
bigibba, Amphora, 19.
biharensis, Navicula inhalata, 107.
bilateralis, Campylodiscus, 49, 177.
bilineata, Rhaphoneis, 142.
bilineatum, Dimeregramma, 73, 142, 178.
binuangana, Cochlostyla (Chrysallis) aspersa, 502, 503, 515.
bipartitus, Actinocyclus, 12, 176.
birostrum, Biddulphia, 34.
bisculpta, Nitzschia, 125, 180.
biseptinarius, Actinoptychus, 15.
biseriata, Caloneis, 109.
  Diploneis, 109, 110.
  Melosira, 93.
  Navicula, 109, 110.
bispinosa, Cidaris (Stephanocidaris), 258.
  Leiocidaris, 258.
  Prionocidaris, 258, 307.
  Rhabdocidaris, 258.
  Stephanocidaris, 259.
bleischiana, Navicula, 96.
bleischii, Navicula, 96.
bolinaoana, Obba marmorata, 338, 339.
bomboides, Navicula, 96.
bongabona, Obba planulata, 361, 364, 367.
boreale, Chaetoceros, 56.
borealis, Diploneis, 106.
bottnica, Navicula, 110.
Bourns, Frank S., 375.
bracteata, Stylocidaris, 258.
branchiata, Navicula, 96, 179.
  Onuphis, 313, 317, 318 (fig.).
Branchiocerianthus imperator, 198, 200.
brasiliensis, Navicula, 97.
Brebissonia, 71.
  weisflogii, 119.
brevipes, Achnanthes, 11.
brevispina, Hercotheca, 82.
brightwellii, Campylodiscus, 49, 51, 52.
  Ditylum, 74.
Broderip, W. J., 374.
broeckii, Biddulphia, 35.
broeckii, Biddulphia (Triceratium), 38.
brookei, Asteromphalus, 30.
  Biddulphia, 35.
browneanus, Campylodiscus, 49, 53, 54.
brunii, Stephanopyxis, 145.
brunnea, Helix, 382.
bukensis, Nitzschia, 126.
bulalacaoana, Cochlostyla (Chrysallis) electrica, 483, 485.
Bulimus, 378, 459.
  albersi, 448.
  albinus, 451.
  aspersa, 501, 504.
  aspersus, 504, 505.
  aspersus wagneri, 512.
  bullula, 451.
  (Eudoxus) bullula, 451.
  cailliaudi, 487.
  calobapta, 456.
  calobaptus, 456, 459, 465.
  chrysalidiformis, 470, 477.
  (Chrysallis) chrysalidiformis, 470.
  cincinniformis, 440, 441, 444.
  cuyoensis, 456.
  dryas, 456, 487.
  (Amphidromus) dryas, 456.
  electricus, 481, 483.
  florida, 411.
  floridus, 411, 416.
  helicoides, 416.
  hydrophana, 409.
  (Orthostylus) hydrophana, 409.
  hydrophanus, 409.
  jonasi, 446.
  labrella, 455.
  leai, 446, 447.
  lichenifer, 481.
  mindoroensis, 501, 505, 508, 510, 512.
  monozonus, 332, 333.
  orbitula, 418.
  pan, 462.
  partuloides, 462.
  (Amphidromus) partuloides, 462.
  porraceus, 455, 458.
  rufogaster, 331, 334, 335.
  rufogastra, 335.
  simplex, 449, 450.
  solidus, 398.
  sylvanus, 456, 487.
  (Orthostylus) turbo, 433.
  ustulatus, 476, 477.
  virgata, 481.
  virgatus, 455, 456, 459.
  (Amphidromus) virgatus, 456.
  wagneri, 501, 512.
Bulinus bullula, 451.
  chrysalidiformis, 470.
  chrysalidiformis var. a and b, 477.
  chrysalidiformis var. d, 473.
  dryas, 455, 459.
  mindoroensis, 501, 505, 508, 510, 512.
  mindoroensis var. k, 483.
  partuloides, 462.
  sylvanus, 455, 458.
  virgatus, 455.
bullata, Navicula, 97, 101.
bullatus, Coscinodiscus, 70.
bullula, Bulimus, 451.
  Bulimus (Eudoxus), 451.
  Bulinus, 451.
  Cochlostyla, 451.
  Eudoxus, 451.

buschi, Cochlostyla, 448.
  Cochlostyla (Eudoxus), 448.
  Eudoxus, 448.
  Helicostyla, 448.
  Helix, 448.
buskii, Plumularia, 199, 221.
busuangensis, Opisthoporus quadrasi, 325.
caballeroi, Secallia, 81, 144, 178.
cabrasensis, Cochlostyla (Hypselostyla) cincinniformis, 436, 444.
  Cochlostyla (Hypselostylus) cincinniformis, 444.
caeca, Navicula, 97, 179.
caelatum, Trigonium, 162.
caelatus, Auliscus, 32.
cagurana, Cochlostyla (Prochilus) fictilis, 467, 468.
cagurayana, Obba planulata, 361, 362, 370, 371.
cailliaudi, Bulimus, 487.
  Cochlostyla, 487.
  Cochlostyla electrica, 487.
  Helicostyla mindoroensis, 487.
calavitana, Cochlostyla (Chrysallis) aspersa, 502, 503, 518.
calawaganensis, Helicostyla chrysalidiformis, 497.
californica, Navicula, 97, 98, 109.
californicus, Stictodiscus, 149, 150, 163, 181.
caliginosa, Navicula, 100.
Callicochlias melanocheila, 382.
calobapta, Amphidromus, 456.
  Bulimus, 456.
  Cochlostyla, 456, 457.
  Cochlostyla (Prochilus), 457.
  Helicostyla, 457.
  Prochilus, 457.
calobaptus, Amphidromus, 456.
  Bulimus, 456, 459, 465.
  Cochlostyla, 465.
  Prochilus, 456.
Calocochlea, 388.
Calocochlea (subgenus), 381.
Caloneis, 124.
  biseriata, 109.
  mexicana, 110.
caloocana, Obba listeri, 345, 353, 354.
Calvinia mirabilis, 230.
Calycella fastigiata, 205.
  plicatilis, 204.
calycifera, Aglaophenia, 199, 231, 237.
camarata, Plumularia, 199, 225, 241.
camelus, Amphora, 19, 28.
camorongana, Cochlostyla (Chrysallis) jayi, 476, 479.
Campanularia, 203.
  fastigiata, 205.
  marginata, 203, 211.
  rufa, 210, 211.
  subrufa, 211.
Campanularidae, 196, 198, 202.
Campanulinidae, 198, 204.
Campeche Bay-Philippine diatoms, 5, 7.
campechiana, Amphipentas, 34.
  Amphora crassa, 7, 20.
  Biddulphia, 8, 35.
campechiana, Navicula californica, 7, 97.
  Nitzschia, 8, 125, 126, 128, 180.
campoensis, Obba listeri, 345, 347, 349, 351.
campylodiscus, Navicula, 8, 97.
Campylodiscus, 2, 48, 50, 156, 158.
  adornatus, 8, 48.
  adriaticus, 48.
  ambiguus, 48, 52.
  anceps, 49, 158.
  bellus, 49.
  biangulatus, 49.
  bilateralis, 49, 177.
  brightwellii, 49, 51, 52.
  browneanus, 49, 53, 54.
  castracanei, 49, 52.
  cocconeiformis, 50.
  comptus, 50.
  concinnus, 50, 52.
  concinnus lineata, 8, 50.
  contiguus, 50, 52.
  crebrecostatus, 50, 52.
  daemelianus, 50.
  decorus, 50, 54.
  dentatus, 51.
  diplostictus, 51, 55.
  dubius, 53.
  emarginatus, 51.
  eximius, 51.
  grevillei, 49, 51.
  hibernicus, 51.
  hodgsonii, 51.
  horologium, 52, 54.
  imperialis, 50, 52.
  incertus, 49, 50, 52, 55.
  inopinus, 52.
  intermedius, 50, 52.
  kinkerii, 49, 51, 52.
  kittonianus, 52.
  latus, 48, 52.
  lepidus, 52.
  ligulosus, 53, 177.
  limbatus, 53.
  lorenzianus, 49.
  macassarensis, 50.
  muelleri, 7, 53.
  noricus, 51.
  orbicularis, 52.
  ornatus, 48, 53.
  perspicuus, 53, 177.
  pfitzeri, 52, 54.
  phalangium, 7, 54.
  philippinarum, 53.
  punctulatus, 7, 54.
  rabenhorstianus, 8, 54.
  ralfsii, 50, 54.
  rattrayanus, 8, 54.
  rivalis, 55.
  robertsianus, 51, 55.
  samoensis, 50, 52, 55.
  scalaris, 54.
  schmidtii, 54.
  similis, 158.
  taeniatus, 55.
  triumphans, 7, 55.
  wallichianus, 55.
  zebuanus, 49.
Campyloneis, 55, 147.

Campyloneis argus, 55.
  grevillei, 55, 147.
  regalis, 55.
cancellata, Navicula, 103, 122.
caniceps, Cochlostyla (Chrysallis), 519, 520, 526, 528.
  Cochlostyla (Chrysallis) caniceps, 501, 520, 524, 527.
canonizadoi, Cochlostyla (Eudoxus), 453.
capax, Mastogloia, 87, 179.
capensis, Isthmia, 85.
capillare, Eudendrium, 198, 201.
capillaris, Hemidiscus, 80.
Caracolla listeri, 344.
caribaea, Navicula, 97, 115.
carinata, Donkinia, 75.
carinifera, Navicula, 7, 95, 96, 98, 175.
Caryodes, 378.
castellifera, Biddulphia, 35.
castelliferum, Triceratium, 48.
castracanei, Campylodiscus, 49, 52.
  Navicula, 98.
  Surirella, 151.
catena, Climacosphenia, 59.
catharina, Plumularia, 224.
cavitala, Cochlostyla (Calocochlea) roissyana, 386, 387, 392.
cebuensis, Mastogloia, 88, 179.
cellulosum, Chaetoceros, 56.
  Triceratium, 42.
cellulosus, Chaetoceros, 56.
centralis, Coscinodiscus, 65, 66, 69.
cepoides, Cochlostyla, 374, 377, 431.
  Cochlostyla (Columplica), 431, 432.
  Cochlostyla (Ptychostylus), 431.
  Cochlostyla (Steatodryas), 431.
  Helicostyla, 431.
  Helix, 431.
  Helix (Helicostyla), 431.
  Ptychostylus, 431.
  Steatodryas, 432.
Cepolis, 378.
Cerataulus, 37, 44, 45.
  rotundus, 37.
  smithii, 44.
  turgidus, 43, 44.
cerina, Cochlostyla (Prochilus), 455, 460.
Cerion, 454.
  incanum, 454.
  peracuta, 455.
  tridentata, 455.
  viaregis, 454.
cervicornis, Lictorella, 212, 213.
cervinus, Coscinodiscus, 65.
  Hyalodiscus, 65, 84.
Cestodiscus, 55, 162.
  cinnamomeum, 55.
  radiolatus, 171.
ceylanense, Plagiogramma, 130.
ceylanensis, Surirella, 151, 154, 157.
Chaetoceros, 2, 55–57, 83, 142.
  affine, 56.
  bacteriastrum, 57.
  boreale, 56.
  cellulosum, 56.
  cellulosus, 56.
  coarctatus, 56.
Chaetoceros coronatum, 83.
  curvisetum, 56.
  diadema, 56, 159.
  furca, 56.
  (Bacteriastrum) hebes, 56, 177.
  lorenzianum, 56.
  lorenzii, 56.
  (Bacteriastrum) medusa, 57, 58, 177.
  (Bacteriastrum) princeps, 57, 177.
  scolopendra, 57.
  sociale, 57.
  (Bacteriastrum) varians, 58.
  wallichii, 57.
challengerensis, Glyphodesmis, 130.
chersonensis, Navicula, 8, 98.
chinensis, Biddulphia, 42.
  Prionocidaris bispinosa, 259.
chrysalidiformis, Bulimus, 470, 477.
  Bulimus (Chrysallis), 470.
  Bulinus, 470.
  Chrysallis, 471, 477.
  Cochlostyla, 469–471, 473, 477.
  Cochlostyla (Chrysallis), 469–471.
  Cochlostyla (Chrysallis) chrysalidiformis, 470, 473.
  Helicostyla, 471.
  Helicostyla (Chrysallis), 471.
  var. a and b, Bulinus, 477.
  var. c, Cochlostyla, 477.
  var. d, Bulinus, 473.
  var. D, Cochlostyla, 473.
Chrysallis (subg.), 469.
Chrysallis adspersa, 505.
  chrysalidiformis, 471, 477.
  chrysalidiformis ustulata, 477.
  electrica, 481, 483, 487.
  melanogaster, 510.
  mindoroensis, 505, 508, 510, 512.
  wagneri, 512.
Chrysanthemodiscus, 58.
  floreatus, 58, 178.
Cidaridae, 243, 245.
cidaridis, Taeniogyrus, 302.
Cidaris annulifera, 257.
  (Cidaris) baculosa, 257.
  (Stephanocidaris) bispinosa, 258.
  (Histocidaris) elegans, 252.
  (Cidaris) glandulosa, 256.
  (Discocidaris) hirsutispinus, 272.
  metularia, 260.
  (Stereocidaris) microtuberculata, 302.
  (Cidaris) reini, 292.
  (Dorocidaris) reini, 292.
Cidarites annulifera, 259.
Cidaroidea, 245.
ciliatus, Coscinodiscus, 65, 178.
cincinna, Cochlostyla, 441.
cincinniformis, Achatina, 440.
  Amphidromus, 440, 441.
  Bulimus, 440, 441, 444.
  Cochlodryas, 441.
  Cochlostyla, 441, 444.
  Cochlostyla (Eudoxus), 441.
  Cochlostyla (Hypselostyla), 435, 436.

- cincinniformis, Cochlostyla (Hypselostyla) cincinniformis, 436, 440.
  - Cochlostyla (Hypselostylus) cincinniformis, 441.
  - Helicostyla, 441.
  - Helix, 440.
  - Hypselostyla, 441.
  - var. a, Helix, 444.
- cingulata, Amphora ocellata, 25.
  - Biddulphia, 35, 36, 177.
- cinnamomeum, Cestodiscus, 55.
  - Trigonium, 8, 162.
- circulare, Triceratium, 40.
- circulifera, Cocconeis, 60, 178.
- circumcincta, Cocconeis, 61.
- circumsecta, Navicula, 98.
- circumvallata, Cymatoneis, 71.
- Cistula, 10, 59.
  - lorenziana, 8, 59.
- citrina, Cocconeis, 61.
- citronella, Cocconeis, 60–62, 111, 112, 178.
- cladothrix, Stylocidaris reini, 293, 294 (fig.), 296, 309, 310.
- clara, Amphora, 19.
- clathrata, Amphora, 19, 176.
- clavata, Navicula, 98, 99, 104.
- Clavicula, 59.
  - polymorpha, 59.
- clavigera, Navicula, 95.
- clepsydra, Navicula, 98.
- Climaconeis, 148.
  - frauenfeldii, 148.
  - lorenzii, 148.
- Climacosira, 141.
- Climacosphenia, 59, 147.
  - catena, 59.
  - elongata, 59, 60.
  - moniligera, 8, 59, 60.
  - scimiter, 59, 177.
- cluthensis, Navicula, 101.
- clypeata, Goniocidaris, 272.
- coarctata, Navicula, 7, 98, 113, 114.
- coarctatus, Chaetoceros, 56.
- cocconeiformis, Achnanthes, 10, 176.
  - Campylodiscus, 50.
  - Mastogloia, 88.
  - Nitzschia, 126, 180.
- Cocconeis, 11, 60, 86, 147.
  - apiculata, 60, 61.
  - circulifera, 60, 178.
  - circumcincta, 61.
  - citrina, 61.
  - citronella, 60–62, 111, 112, 178.
  - composita, 62.
  - curvirotunda, 62.
  - cyclophora, 62.
  - distans, 62.
  - divisa, 63.
  - fulgur, 63.
  - heteroidea, 62, 63.
  - hospes, 63.
  - insignis, 63.
  - ocellata, 63, 178.
  - oculus-cati, 63.
  - os-pristis, 63, 178.
  - pellucida, 61, 64.
  - pinnata, 64.
- Cocconeis pseudomarginata, 64.
  - robusta, 62.
  - scutellum, 62.
  - transversa, 64.
- Cochlodryas (subg.), 410.
- Cochlodryas albersi, 448.
  - cincinniformis, 441.
  - floridus, 411.
  - hydrophanus, 409.
  - turbo, 433.
- Cochlostyla of Mindoro Province, 373.
- Cochlostyla (subg.), 407.
- Cochlostyla, 375, 377–379, 398.
  - aegrota, 380, 381.
  - (Corasia) aegrota, 380.
  - albina, 451.
  - (Eudoxus) albina, 451.
  - (Chrysallis) albolabris, 492, 493.
  - (Chrysallis) albolabris albolabris, 493, 494.
  - (Chrysallis) albolabris robusta, 493.
  - antoni(i), 495, 496.
  - (Chrysallis) antoni, 494, 495.
  - (Chrysallis) antoni antoni, 495, 496.
  - (Chrysallis) antoni macilenta, 495, 496.
  - (Calocochlea) aopta, 381, 385.
  - aspersa, 505.
  - (Chrysallis) aspersa, 501, 503, 504, 526.
  - (Chrysallis) aspersa aspersa, 503, 504, 514.
  - (Chrysallis) aspersa binuangana, 502, 503, 515.
  - (Chrysallis) aspersa calavitana, 502, 503, 518.
  - (Chrysallis) aspersa edgari, 502, 503, 514, 518.
  - (Chrysallis) aspersa ilogana, 502, 503, 517.
  - (Chrysallis) aspersa juani, 502, 503, 507.
  - (Chrysallis) aspersa lunai, 502, 503, 505.
  - aspersa melanogaster, 502, 503.
  - (Chrysallis) aspersa melanogaster, 517.
  - (Chrysallis) aspersa mindoroensis, 455, 501, 503, 505, 508.
  - (Chrysallis) aspersa wagneri, 501, 503, 512.
  - bullula, 451.
  - buschi, 448.
  - (Eudoxus) buschi, 448.
  - cailliaudi, 487.
  - calobapta, 456, 457.
  - (Prochilus) calobapta, 457.
  - calobapta contracta, 465.
  - calobapta nana, 465.
  - calobaptus, 465.
  - (Chrysallis) caniceps, 519, 520, 526, 528.
  - (Chrysallis) caniceps caniceps, 501, 520, 524, 527.
  - (Chrysallis) caniceps conica, 520, 523.
  - (Chrysallis) caniceps contracostana, 520, 522.

Cochlostyla (Chrysallis) caniceps demesai, 520, 523.
(Chrysallis) caniceps maita, 520, 522, 523.
(Chrysallis) caniceps minuta, 520, 527.
(Eudoxus) canonizadoi, 453.
cepoides, 374, 377, 431.
(Columplica) cepoides, 431, 432.
(Ptychostylus) cepoides, 431.
(Steatodryas) cepoides, 431.
(Prochilus) cerina, 455, 460.
chrysalidiformis, 469–471, 473, 477.
(Chrysallis) chrysalidiformis, 469–471.
chrysalidiformis antoni, 495.
(Chrysallis) chrysalidiformis chrysalidiformis, 470, 473.
(Chrysallis) chrysalidiformis enodosa, 470, 473, 474.
(Chrysallis) chrysalidiformis fuscata, 470, 475.
(Chrysallis) chrysalidiformis macra, 470, 472.
(Chrysallis) chrysalidiformis rarior, 470, 473.
chrysalidiformis ustulatus, 477.
chrysalidiformis var. c, 477.
chrysalidiformis var. D, 473.
(Chrysallis) chrysalidiformis villosa, 470, 473, 475.
cincinna, 441.
cincinniformis, 441, 444.
(Eudoxus) cincinniformis, 441.
(Hypselostyla) cincinniformis, 435, 436.
(Hypselostyla) cincinniformis cabrasensis, 436, 444.
(Hypselostylus) cincinniformis cabrasensis, 444.
(Hypselostyla) cincinniformis cincinniformis, 436, 440.
(Hypselostylus) cincinniformis cincinniformis, 441.
(Hypselostyla) cincinniformis demesana, 436, 438.
(Hypselostylus) cincinniformis demesana, 438.
(Hypselostyla) cincinniformis guntingana, 436, 442.
(Hypselostylus) cincinniformis guntingana, 442.
(Hypselostyla) cincinniformis lubanensis, 436, 444.
(Hypselostylus) cincinniformis lubanensis, 444.
(Hypselostyla) cincinniformis menagei, 436, 439.
(Hypselostylus) cincinniformis menagei, 439.
cincinniformis tritaeniata, 441.
(Hypselostyla) cincinniformis ultima, 436, 439.
(Hypselostylus) cincinniformis ultima, 436.
cincinniformis unitaeniata, 441.
Cochlostyla cinerascens turbo, 433.
(Prochilus) cuyoensis, 455, 464, 465.
(Prochilus) cuyoensis contracta, 465, 466.
(Prochilus) cuyoensis subpallida, 465, 466.
decora, 430.
(Cochlodryas) decora, 430.
dimera, 406.
(Helicostyla) dimera, 405.
dolium, 431.
dryas, 456, 457.
(Prochilus) dryas, 460.
dryas porracea, 457.
(Eudoxus) effusa, 446.
electrica, 481, 483–485, 487, 496.
(Chrysallis) electrica, 482, 483.
(Chrysallis) electrica bulalacaoana, 483, 485.
electrica cailliaudi, 487.
(Chrysallis) electrica electrica, 483, 485.
(Chrysallis) electrica mangarina, 483, 484.
(Orthostylus) euconica, 434.
(Cochlodryas) fastidiosa, 427.
fictilis, 468.
(Prochilus) fictilis, 466, 467.
(Prochilus) fictilis ambulonensis, 467, 468.
(Prochilus) fictilis fictilis, 467.
(Prochilus) fictilis fulva, 467.
(Prochilus) fictilis cagurana, 467, 468.
(Prochilus) fictilis larvata, 467.
(Prochilus) fictilis mangarina, 466.
florida, 411, 416.
(Cochlodryas) florida, 410, 411, 418.
(Cochlodryas) florida aureola, 411, 414.
(Cochlodryas) florida florida, 411, 418.
florida fuscolabiata, 413.
(Cochlodryas) florida fuscolabiata, 411, 413.
florida helicoides, 416.
(Cochlodryas) florida helicoides, 411, 416.
(Cochlodryas) florida signa, 411, 414.
(Helicostyla) fulgens, 400.
(Helicostyla) fulgens fulgens, 400, 401, 404, 405.
(Helicostyla) fulgens johnsoni, 400, 404.
(Helicostyla) fulgens sapolana, 400, 404.
gertrudis, 398.
(Calocochlea) gertrudis, 381, 398.
(Cochlodryas) halichlora, 454.
helicoides, 416.
(Cochlodryas) helicoides, 410.
hydrophana, 409.
(Cochlostyla) hydrophana, 407, 408.
(Cochlostyla) hydrophana hydrophana, 408, 409.

Cochlostyla (Cochlostyla) hydrophana varaderoana 408, 410.
(Chrysallis) jayi, 476.
(Chrysallis) jayi camorongana, 476, 479.
(Chrysallis) jayi jayi, 476, 478, 479.
(Chrysallis) jayi perpusilla, 476, 478.
jonasi, 447, 448.
(Eudoxus) jonasi, 446, 449.
(Phengus) jonasi, 448.
(Prochilus) larvata, 467.
leai, 447.
lichenifer, 481, 487.
(Chrysallis) lichenifer, 480.
(Chrysallis) lichenifer avittata, 480, 481.
(Chrysallis) lichenifer lichenifer, 480, 481.
(Halocochlea) lillianae, 376, 399.
(Cochlodryas) mateoi, 422, 423, 429.
(Cochlodryas) mateoi mateoi, 422, 426.
(Cochlodryas) mateoi sibolonensis, 422, 425.
(Cochlodryas) mateoi subsp., 426.
melanocheila, 382.
(Calocochlea) melanocheila, 381, 385.
melanochila, 382.
(Callicochlias) melanochila, 382.
melanogaster, 510.
metaformis, 378, 409.
(Cochlostyla) metaformis, 407.
(Dryocochlias) metaformis, 409.
metaformis hydrophana, 409.
mindoroensis, 475, 488, 500, 501, 505, 508, 510, 512.
mindoroensis melanogaster, 510.
mindoroensis wagneri, 501.
mirabilis, 378.
(Helicostyla) mirabilis, 400.
mirabilis fulgens, 401.
monozona, 333.
monozonus, 333.
(Chrysallis) nigriceps, 526–528.
(Chrysallis) nigriceps nigriceps, 528, 529.
(Chrysallis) nigriceps nubifer, 528, 530.
(Chrysallis) nigriceps obnubila, 528, 530.
nigrocincta, 462.
(Hypselostyla) nympha, 435.
orbitula, 418, 419.
(Cochlodryas) orbitula, 418.
orbitulus, 419.
(Chrysallis) palliobasis, 486.
partuloides, 462.
(Prochilus) partuloides, 462.
(Calocochlea) perpallida, 381, 384.
(Chrysallis) perturbator, 531.
(Chrysallis) petiti, 487.
(Chrysallis) pettiti, 487.
(Orthostylus) pithogaster, 434, 435.
(Cochlodryas) polychroa, 410.
porracea, 457.
Cochlostyla (Calocochlea) pulcherrima, 381.
(Prochilus) pulchrior, 458.
roissyana, 389, 394, 397, 398.
(Calocochlea) roissyana, 381, 386, 391.
(Calocochlea) roissyana bartschi, 387, 388, 393.
(Calocochlea) roissyana cavitala, 386, 387, 392.
roissyana cuticulare, 389.
(Calocochlea) roissyana laymansa, 387, 397.
roissyana lutea, 391.
(Calocochlea) roissyana lutea, 387, 391.
(Calocochlea) roissyana manlaysa, 387, 396.
(Calocochlea) roissyana monacha, 387.
(Calocochlea) roissyana roissyana, 387, 393.
roissyana solida, 398.
roissyana subatra, 389.
(Calocochlea) roissyana subatra, 387, 389.
roissyana var., 397.
roissyana var. c, 391.
roissyana var. d, 397.
roissyana var. e, 396.
roissyana var. m, 391.
roissyana var. q, 398.
rollei, 489, 493.
(Chrysallis) rollei, 487. 488, 502, 504.
(Chrysallis) rollei niger, 491.
(Chrysallis) rollei nigra, 488, 489, 491.
(Chrysallis) rollei osborni, 488, 489.
(Chrysallis) rollei rollei, 488.
(Chrysallis) rollei vexator, 488–490.
(Chrysallis) roseolabra, 497.
(Chrysallis) roseolabra rosea, 497–499.
(Chrysallis) roseolabra roseolabra, 497.
rufogaster, 329–337.
rufogaster antipolana, 332–334.
rufogaster banahaoana, 336.
rufogaster benguetana, 330.
rufogaster juani, 329, 330.
rufogaster manilana, 332, 334.
rufogaster monozona, 332, 334. 335.
rufogaster montalbana, 330, 331, 334, 336.
rufogaster rufogaster, 331, 334.
rufogaster subsp., 337.
rufogaster toppingi, 336.
rufogastra, 330, 333, 335.
(Helicobulinus) sarcinosa, 433.
simplex, 450.
(Eudoxus) simplex, 449, 453.
(Prochilus) sp., 460.
(Eudoxus) steerei, 451.
(Calocochlea) subatra, 393.
sylvanoides, 456, 459.
(Prochilus) sylvanus, 460.
tenera, 422, 423, 426, 427.
(Cochlodryas) tenera, 423, 429.

Cochlostyla turbo, 433, 434.
(Helicobulinus) turbo, 433.
(Rhymbocochlias) turbo, 434.
ustulata, 470, 477.
virgata, 456, 457.
(Prochilus) virgata, 454, 455, 457, 460, 462, 465.
virgata alampe, 457.
virgata porracea, 457.
virgata pulchrior, 457.
virgata sylvanoides, 457.
virginea, 451, 452.
(Corasia) virgo, 380.
wagneri, 512.
coeli, Aulacodiscus voluta, 31.
collaris, Lysidice, 193.
Columplica dolium, 431.
comis, Surirella, 152.
compacta, Achnanthes, 10, 176.
Amphora, 19, 176.
Coscinodiscus apollinis, 64.
compactum, Rhoicosigma, 143.
composita, Cocconeis, 62.
compositus, Auliscus, 32.
comptus, Campylodiscus, 50.
concava, Biddulphia, 35.
concavum, Triceratium, 35.
concentrica, Surirella, 152, 181.
concinna, Mastogloia, 91.
concinnus, Campylodiscus, 50, 52.
concinnus, Coscinodiscus, 65.
conica, Cochlostyla (Chrysallis) caniceps, 520, 523.
consimilis, Biddulphia, 36.
consors, Navicula, 98.
constricta, Amphora lineata, 24.
Mastogloia, 87.
constrictum, Plagiogramma, 130.
contabulatus, Gyroptychus, 13.
contigua, Navicula, 101.
Surirella, 152, 181.
contiguus, Campylodiscus, 50, 52.
continuata, Surirella, 153, 181.
contorta, Hebella, 198, 207.
contracostana, Cochlostyla (Chrysallis) caniceps, 520, 522.
contracta, Cochlostyla calobapta, 465.
Cochlostyla (Prochilus) cuyoensis, 465, 466.
contumax, Trigonium, 162, 182.
convallaria, Lafoea, 211, 212.
Zygophylax, 195, 199, 211.
convexus, Coscinodiscus, 95.
Corasia (subg.), 380.
Corasia aegrota, 380.
Corethron, 161.
Corinna, 172.
cornigera, Biddulphia, 36, 39, 177.
cornuta, Biddulphia, 37.
Sertularella, 195, 199, 215, 216, 241.
Sertularella polyzonias, 215.
cornutum, Triceratium, 44.
coronalis, Polymyxus, 14.
coronaria, Melosira, 92.
coronatum, Chaetoceros, 83.
corpulenta, Amphora, 18, 20.
Navicula, 99, 179.
Coscinodiscus, 2, 58, 64, 68, 70, 76, 84, 95, 157, 175.
africanus, 64.
apollinis, 64.
apollinis compacta, 64.
asteromphalus, 65, 95.
biangulatus, 65, 95.
bullatus, 70.
centralis, 65, 66, 69.
cervinus, 65.
ciliatus, 65, 178.
concinnus, 65.
convexus, 95.
denarius, 71.
denticulatus, 66.
devius, 69.
elongatus, 175.
excentricus, 66, 67.
exiguus, 7, 66.
galapagensis, 64.
gazellae, 66.
gigas, 69.
griseus, 64.
heteromorphus, 66.
horridus, 65.
humilis, 175.
janischii, 67.
kuetzingii, 67.
kutzingii, 67.
lentiginosus, 67.
leptopus, 67.
lineatus, 67, 68.
marginatus, 67.
micans, 68, 69.
nano-lineatus, 68, 178.
nitidulus, 8, 68.
nitidus, 69.
nobilis, 69.
nodulifer, 69.
normanii, 69.
oculus-iridis, 65, 69.
omphalanthus, 65.
praetextus, 69.
pustulatus, 69.
radiatus, 69.
radiosus, 68, 69.
reniformis, 69, 150, 151.
rex, 66, 70.
robustus, 67.
scintillans, 64.
scitulus, 70, 178.
spendidus, 66.
subtilis, 70.
subvelatus, 68.
symmetricus, 70.
tubiformis, 70.
variolatus, 8, 71, 178.
costata, Amphora, 20, 21.
costatum, Skeletonema, 145.
crabro, Navicula, 95, 99, 105, 111, 113, 114, 120, 121.
Craspedodiscus, 71.
insignis, 71.
crassa, Amphora, 8, 20.
crassilineata, Cyclotella, 71, 178.
craticula, Surirella, 147.
crebrecostatus, Campylodiscus, 50, 52.
crenulata, Achnanthes, 11.

Crepidula, 291.
cruciata, Mastogloia, 88.
crucifix, Navicula, 119.
Cryptolaria pulchella, 210.
crystallina, Synedra, 159.
cucumeris, Amphora, 20, 176.
culcitella, Biddulphia, 37.
Cuming, Hugh, 374.
cuneata, Sceptroneis, 144, 159, 181.
  Surirella, 153.
  Synedra, 159.
cuneatella, Surirella, 153, 181.
cuneiformis, Hemidiscus, 80.
cupressina, Aglaophenia, 231.
curvatulus, Actinocyclus, 12.
curvifacies, Surirella, 154.
curvirotunda, Cocconeis, 62.
curvisetum, Chaetoceros, 56.
curvitheca, Zygophylax, 196, 199, 212, 241.
cuspidata, Biddulphia, 37.
  Navicula, 89, 99, 147.
cuticulare, Cochlostyla roissyana, 389.
cuticularis, Helicostyla (Calocochlea) roissyana, 389.
cuyoensis, Bulimus, 456.
  Cochlostyla (Prochilus), 455, 464, 465.
cyclamen, Triceratium, 34.
  Trigonium, 161.
cycloides, Biddulphia, 37, 177.
cyclophora, Cocconeis, 62.
cyclops, Navicula, 99, 179.
Cyclophoridae, 323.
Cyclotella, 71.
  crassilineata, 71, 178.
  striata, 71.
cylindrica, Nemertesia, 199, 227.
  Plumularia, 228.
Cymatogonia, 14.
Cymatoneis, 10, 59, 71.
  circumvallata, 71.
  definita, 72, 178.
  lacunata, 72, 178.
  sufflata, 72, 178.
  sulcata, 8, 71, 73, 122.
Cymatopleura, 9.
Cymbella, 73.
  ehrenbergii, 73.
  gastroides, 73.
cymbelloides, Amphora, 18.
cymbifera, Amphora, 20, 21.
Cyrtocidaris (subg.), 264, 283, 285.
Cystopleura, 9.
daemelianus, Campylodiscus, 50.
daemon, Syringidium, 160.
danica, Achnanthes, 12.
danicum, Achnanthidium, 12.
davyana, Entogonia, 166.
debyi, Licmophora, 86, 178.
decora, Cochlostyla, 430.
  Cochlostyla (Cochlodryas), 430.
  Helicostyla, 430.
  Helix, 430.
decorum, Pleurosigma, 134, 139.
decorus, Acavus (Tachea), 430.
  Campylodiscus, 50, 54.
decussatus, Actinocyclus, 12, 176.
definita, Cymatoneis, 72, 178.
deflexa, Surirella, 154, 156.
delecta, Navicula, 100, 180.
delicatula, Auliscus caelatus, 32.
delphinia, Amphora, 22.
demesai, Cochlostyla (Chrysallis) caniceps, 520, 523.
demesana, Cochlostyla (Hypselostyla) cincinniformis, 436, 438.
  Cochlostyla (Hypselostylus) cinniformis, 438.
  Helicostyla cincinniformis, 438.
denarius, Coscinodiscus, 71.
dendritica, Plumularia, 199, 223, 224, 226.
densestriata, Navicula forcipata, 102.
densistriata, Navicula forcipata, 8.
dentatus, Campylodiscus, 51.
Denticella, 39.
  lauta, 16.
  marina, 73.
  staurophora, 130.
denticulatus, Coscinodiscus, 66.
Dentitheca, 197.
Desmoscyphus, 196.
  longitheca, 218.
devius, Coscinodiscus, 69.
diadema, Chaetoceros, 56, 159.
  Syndendrium, 159.
  Syringidium, 56.
diaphanum, Trigonium, 163, 169, 182.
Diatoms, marine, 1.
dichotoma, Amphora, 21, 176.
Dictyocladium, 215.
  aberrans, 195, 199, 214, 241.
Dictyoneis thumii, 108.
diducta, Amphora, 21.
didyma, Navicula, 101.
diffusa, Navicula, 8, 101.
digitalis, Diphasia, 199, 218.
  Sertularia, 218.
digito-radiata, Navicula, 111.
dimera, Cochlostyla, 406.
  Cochlostyla (Helicostyla), 405.
  Helicostyla, 405, 406.
  Helix, 405, 406.
Dimeregramma, 73.
  bilineatum, 73, 142, 178.
  fluens, 73, 178.
  inflatum, 73.
  minus, 74.
  nanum, 74.
  opulens, 74, 178.
  prismaticum, 74, 178.
dimorpha, Stegopoma, 198, 206, 241.
Diphasia, 220.
  digitalis, 199, 218.
  huerteli, 199, 218, 241.
  inornata, 199, 219, 241.
  kincaidi, 220.
Diploneis, 124.
  biseriata, 109, 110.
  borealis, 106.
  platessa, 123.
  vespa, 124.
diplosticta, Navicula, 101.
  Triceratium venulosum, 46.

diplostictus, Campylodiscus, 51, 55.
Discocidaris mikado, 277.
  serrata, 276.
discursa, Biddulphia, 37, 177.
dissimile, Trigonium, 165, 170.
distans, Cocconeis, 62.
  Nitzschia, 126.
distincta, Biddulphia, 38.
distinctum, Plagiogramma, 130, 181.
Ditylium, 74.
Ditylum, 74.
  brightwellii, 74.
divaricata, Aglaophenia, 199, 232.
  Plumularia, 232.
divergens, Dynamena, 213.
  Sertularia, 199, 213.
diversa, Navicula, 125.
divisa, Cocconeis, 63.
doliolus, Pseudo-Eunotia, 140, 181.
dolium, Cochlostyla, 431.
  Columplica, 431.
  Helix, 431.
  Nanina, 431.
  Pachya, 431.
  Stylodon, 431.
  Stylodonta, 431.
dolosum, Pleurosigma, 133, 181.
Donkinia, 74, 131, 132, 142.
  carinata, 75.
  reticulata, 75.
Dorocidaris reini, 292.
dorsalis, Amphora, 28.
dromas, Amphora, 19.
dryas, Bulimus, 456, 487.
  Bulimus (Amphidromus), 456.
  Bulinus, 455, 459.
  Cochlostyla, 456, 457.
  Cochlostyla (Prochilus), 460.
  Helicostyla, 457.
  Prochilus, 456.
dubia, Biddulphia, 38.
  Fragilaria, 77.
  Sertularia, 213.
dubius, Campylodiscus, 53.
dulce, Triceratium, 173.
  Trigonium, 165.
dura, Amphora, 22, 176.
  Melosira, 92, 179.
durandii, Navicula, 101, 179.
Dymella, 198.
Dynamena, 196.
  divergens, 213.
Echinodiscus, 75.
  vermiculatus, 75, 178.
Echinoidea—The Cidaridae, 243.
echinulata, Psilocidaris, 283, 284 (fig.), 308, 310, 311.
ecijana, Obba marmorata, 338, 340, 341.
edgari, Cochlostyla (Chrysallis) aspersa, 502, 503, 514, 518.
effluens, Stylocidaris, 285, 290 (fig.), 292, 294, 308–310, 312.
effusa, Acanthella, 199, 229, 241.
  Cochlostyla (Eudoxus), 446.
  Plumularia, 229.
egeria, Navicula, 91.
egregia, Amphora, 8, 19, 22.
  Mastogloia, 88.
ehrenbergii, Actinocyclus, 165.
  Arachnoidiscus, 29.
  Cymbella, 73.
  Licmophora, 86.
electrica, Chrysallis, 481, 483, 487.
  Cochlostyla, 481, 483–485, 487, 496.
  Cochlostyla (Chrysallis), 482, 483.
  Cochlostyla (Chrysallis) electrica, 483, 485.
  Helicostyla, 481, 483, 487.
  Helicostyla (Chrysallis) mindoroensis, 520.
electricus, Bulimus, 481, 483.
elegans, Asteromphalus, 30.
  Biddulphia, 8.
  Cidaris (Histocidaris), 252.
  Histocidaris, 247, 250, 252–253 (fig.), 307, 310.
  Mastogloia, 88.
  Porocidaris, 250.
  Thuiaria, 220.
elegantissimum, Pleurosigma, 133.
elliptica, Navicula, 121.
  Navicula lyra, 108.
elongata, Climacosphenia, 59, 60.
  Glyphodesmis, 78.
  Iphionella, 313, 315 (fig.).
  Mastogloia, 91.
  Navicula, 101.
  Willemoesia, 175.
elongatum, Pleurosigma, 134.
elongatus, Coscinodiscus, 175.
emarginatus, Campylodiscus, 51.
Endictya, 68, 71, 75, 76.
  margaritifera, 75, 178.
  minor, 76.
  oceanica, 76, 77.
Endyctia, 68.
enodosa, Cochlostyla (Chrysallis) chrysalidiformis, 470, 473, 474.
Entogonia davyana, 166.
Epithemia, 9, 77, 86.
  monilifera, 86.
  zebra, 16, 77.
epsilon, Rutilaria, 144.
erebi, Amphora, 21.
erythraea, Navicula, 101.
Ethmodiscus, 66, 76.
Eucidaris, 260.
  metularia, 260.
euconica, Cochlostyla (Orthostylus), 434.
Eucyclotus, 323.
Eudendridae, 198, 201.
Eudendrium attenuatum, 202.
  capillare, 198, 201.
eudoxia, Navicula, 101.
Eudoxus (subg.), 446.
Eudoxus bullula, 451.
  buschi, 448.
  jonasi, 448.
  simplex, 449.
eulensteinii, Stictodiscus, 149, 166.
  Triceratium, 166, 167.
  Trigonium, 149, 161, 166–168, 170, 171.
Eunotia, 140.
Euodia, 77, 80, 86.

Euodia arcuata, 80.
janischii, 77.
Eupanthalis, 186.
evanida, 186, 187 (fig.).
Euphyllodium spathulatum, 140.
evanida, Eupanthalis, 186, 187 (fig.).
exacta, Biddulphia, 38, 177.
exarata, Mastogloia, 90.
excavata, Navicula, 8, 102, 113, 115, 179.
excentricus, Coscinodiscus, 66, 67.
exempta, Navicula, 113.
exemptum, Pleurosigma, 134, 137, 181.
exigua, Achnanthes, 12.
exiguus, Coscinodiscus, 7, 66.
eximia, Navicula, 102.
eximius, Campylodiscus, 51.
expedita, Biddulphia, 36, 39.
Navicula, 102.
expressum, Triceratium, 42.
exsecta, Amphora, 8, 22.
facilis, Surirella, 154, 182.
fallax, Mastogloia, 87.
falx, Pleurosigma, 134, 181.
fasciata, Schizocidaris, 243, 276, 280, 281 (fig.), 308, 310, 311.
Stegopoma, 206.
fastidiosa, Cochlostyla (Cochlodryas), 427.
fastigiata, Calycella, 205.
Campanularia, 205.
Stegopoma, 205.
fastuosa, Surirella, 7, 153–156, 159.
fausta, Surirella, 155, 182.
favus, Biddulphia, 37–39, 46, 165.
fictilis, Cochlostyla, 468.
Cochlostyla (Prochilus), 466, 467.
Cochlostyla (Prochilus) fictilis, 467.
fimbriata, Biddulphia, 39.
fimbriatum, Triceratium, 47.
flabellata, Plumularia, 199, 223, 241.
flabellum, Synthecium, 221.
flahaulti, Achnanthes, 11.
flava, Halicornaria, 238.
flavipellis, Helicostyla (Chrysallis) mindoroensis, 497.
flexa, Amphora, 22, 176.
flexuosa, Grammatophora, 79.
floreatus, Chrysanthemodiscus, 58, 178.
florida, Bulimus, 411.
Cochlostyla, 411, 416.
Cochlostyla (Cochlodryas), 410, 411, 418.
Cochlostyla (Cochlodryas) florida, 411, 418.
Helicostyla, 411, 416.
Helix, 411, 416.
Helix (Cochlogena), 411.
var. a, Helix (Cochlogena), 416.
floridus, Bulimus, 411, 416.
Cochlodryas, 411.
Helix, 411, 413, 416.
Orthostylus, 411.
florigera, Goniocidaris, 276.
fluens, Dimeregramma, 73, 178.
fluminensis, Nitzschia, 8, 126, 127.
Surirella, 7, 155.
foliata, Surirella, 152, 181.
forcipata, Navicula, 102, 111.
formicina, Navicula, 7, 102.
formosa, Amphora, 8, 23.
Synedra, 160.
formosum, Pleurosigma, 132, 135.
Trigonium, 164, 169.
var., Trigonium, 164.
forresterii, Triceratium, 37.
fossilis, Navicula lacrimans, 107.
fractosa, Biddulphia, 39, 177.
Fragilaria, 77, 78.
angustata, 77.
dubia, 77.
fragilis, Tropidoneis, 173, 174.
Francisco, Mateo, 375.
frauenfeldii, Climaconeis, 148.
Thalassiothrix, 160.
Trigonium, 169.
Frustulia, 10.
rhomboides, 147.
fulgens, Cochlostyla (Helicostyla), 400.
Cochlostyla (Helicostyla) fulgens, 400, 401, 404, 405.
Cochlostyla mirabilis, 401.
Helicostyla, 401.
Helicostyla (Helicostyla), 401, 404.
Helicostyla mirabilis, 401.
Helix, 401.
Helix (Helicostyla), 401.
Synedra, 159.
fulgur, Cocconeis, 63.
fulva, Cochlostyla (Prochilus) fictilis, 467.
fundata, Grammatophora, 78, 178.
funiculata, Navicula, 102, 179.
furca, Chaetoceros, 56.
furcata, Amphora, 8, 23.
furcatum, Bacteriastrum, 58.
furva, Helicostyla (Chrysallis) mindoroensis, 515.
fusca, Amphora, 8, 23.
fusca, Navicula, 103, 106, 114, 121.
fuscata, Cochlostyla (Chrysallis) chrysalidiformis, 470, 475.
fuscolabiata, Cochlostyla florida, 413.
Cochlostyla (Cochlodryas) florida, 411, 413.
fusiformis, Mastogloia, 88, 179.
galapagense, Triceratium, 166–168.
galapagensis, Coscinodiscus, 64.
gallinula, Obba, 343.
gastroides, Cymbella, 73.
gazellae, Coscinodiscus, 66.
gemina, Biddulphia, 40.
geminum, Trigonium, 169.
gemma, Surirella, 152.
gemmata, Navicula, 103, 116.
gemmatula, Navicula, 95, 103, 107.
genetta, Hesione, 189.
gertrudis, Cochlostyla, 398.
Cochlostyla (Calocochlea), 381, 398.
gibba, Amphora, 8, 23.
gibbosa, Biddulphia, 40.
Stictodiscus parallelus, 150.
gibbosum, Trigonium, 169.
gigantea, Amphora, 8, 23.
gigas, Coscinodiscus, 69.
gilberti, Stegopoma, 207.

glabrissima, Navicula, 103, 179.
glandulosa, Cidaris (Cidaris), 256.
  Prionocidaris, 256.
  Stephanocidaris, 256.
globosum, Triceratium, 40.
Glyphodesmis, 77.
  acus, 78, 178.
  challengerensis, 130.
  elongata, 78.
  margaritacea, 78.
  murrayana, 131.
  williamsonii, 77.
godeffroyi, Amphipentas, 34.
Goniocidaris, 244, 261, 264, 268, 271, 283, 285.
  clypeata, 272.
  florigera, 276.
  (Discocidaris) mikado, 262, 264.
  (Discocidaris) peltata, 244, 261, 262 (fig.), 307, 310, 311.
  (Cyrtocidaris) tenuispina, 264, 266 (fig.), 268 (fig.), 270, 285, 307, 308, 310, 311.
  (Cyrtocidaris) tenuispina major, 270, 271 (fig.), 308, 311.
  (Cyrtocidaris) tenuispina tuberculata, 268–270 (fig.), 271, 272, 307, 308, 310, 311.
  umbraculum, 272, 273.
gowenii, Melosira, 93, 179.
gracilis, Stegopoma, 198, 205.
graeffei, Amphora, 23.
  Nitzschia, 127.
graeffeiana, Amphitetras, 164.
graeffii, Navicula, 8, 103, 179.
Grammatophora, 78.
  flexuosa, 79.
  fundata, 78, 178.
  islandica, 79.
  longissima, 79.
  marina, 79.
  oceanica, 79.
  probata, 79, 178.
  punctata, 79.
  serpentina, 79.
grandis, Stereocidaris, 299, 301, 309.
grandiuscula, Surirella, 155.
granulata, Nitzschia, 127.
granulosa, Nitzschia, 127.
grave, Triceratium, 46.
gravis, Surirella, 155, 181.
grayii, Actinodiscus, 14.
gregorianum, Plagiogramma, 130.
gregorii, Navicula, 103.
  Navicula cancellata, 103.
grevilleana, Amphora, 23.
grevillei, Campylodiscus, 49, 51.
  Campyloneis, 55, 147.
  Navicula, 128.
griffini, Pasythea, 221.
griseus, Coscinodiscus, 64.
gruendleri, Mastogloia, 89.
  Navicula (Alloioneis), 104.
grundleri, Alloioneis, 105.
  Amphora, 8, 23.
  Biddulphia, 40.
  Mastogloia, 7.
  Navicula, 105.
grundleri, Navicula (Alloioneis), 118.
grunowiana, Biddulphia, 40.
grunowii, Mastogloia, 91.
guntingana, Cochlostyla (Hypselostyla) cincinniformis, 436, 442.
  Cochlostyla (Hypselostylus) cincinniformis, 442.
Gyroptychus, 79.
  contabulatus, 13.
Gyrosigma, 9, 131.
  thuringicum, 9.
halcona, Obba listeri, 345, 348.
Halecidae, 198, 202.
Halecium lighti, 198, 202.
  sessile, 202.
halichlora, Cochlostyla (Cochlodryas), 454.
Halicornaria, 238, 239.
  flava, 238.
  hians, 199, 237.
  ishikawai, 238.
  magnirostris, 199, 238, 242.
  tenuirostris, 199, 237, 242.
Halocochlea (subg.), 399.
hamulifera, Navicula, 104.
hamuliferum, Pleurosigma, 135.
Hantzschia, 16.
hardmanianus, Auliscus, 32.
  Hemidiscus, 80.
hargitti, Plumularia, 199, 224, 241.
hawaiensis, Lytocarpus, 234, 235.
Hebella contorta, 198, 207.
  neglecta, 198, 208.
  spiralis, 198, 208, 241.
Hebellidae, 198, 207.
hebes, Chaetoceros (Bacteriastrum), 56, 177.
hebetata, Rhizosolenia, 142.
Heibergia barbadensis, 166.
Helicobulinus (subg.), 433.
Helicobulinus turbo, 433.
helicoides, Bulimus, 416.
  Cochlostyla, 416.
  Cochlostyla (Cochlodryas), 410.
  Cochlostyla florida, 416.
  Cochlostyla (Cochlodryas) florida, 411, 416.
Helicostyla (subg.), 399.
Helicostyla, 377, 378.
  aegrota, 381.
  (Calocochlea) aopta, 385.
  buschi, 448.
  calobapta, 457.
  cepoides, 431.
  chrysalidiformis, 471.
  (Chrysallis) chrysalidiformis, 471.
  chrysalidiformis antoni, 495.
  chrysalidiformis calawaganensis, 497.
  chrysalidiformis ustulatus, 477.
  cincinniformis, 441.
  cincinniformis demesana, 438.
  cincinniformis lubanensis, 444.
  cincinniformis ultima, 436.
  decora, 430.
  dimera, 405, 406.
  dryas, 457.
  electrica, 481, 483, 487.

Helicostyla florida, 411, 416.
fulgens, 401.
(Helicostyla) fulgens, 401, 404.
hydrophana, 409.
jonasi, 446–448.
leai, 447.
mcgintyi, 486.
melanochila, 382, 388.
(Calocochlea) melanochila, 382.
mindoroensis, 505, 508, 510, 512.
(Chrysallis) mindoroensis, 503, 507, 510.
mindoroensis cailliaudi, 487.
(Chrysallis) mindoroensis electrica, 520.
(Chrysallis) mindoroensis flavipellis, 497.
(Chrysallis) mindoroensis furva, 515.
(Chrysallis) mindoroensis ilogana, 531.
(Chrysallis) mindoroensis orotis, 486.
(Chrysallis) mindoroensis parallaxis, 517, 518.
mirabilis fulgens, 401.
orbitula, 418, 419.
(Prochilus) partuloides, 462.
(Orthostylus) pithogaster, 434.
porracea, 457.
roissyana, 393, 394.
(Calocochlea) roissyana, 394.
(Calocochlea) roissyana bartschi, 388.
(Calocochlea) roissyana cuticularis, 389.
roissyana lutea, 391.
(Calocochlea) roissyana monacha, 387.
roissyana subatra, 389.
(Chrysallis) rollei, 488.
rufogastra, 335.
rufogastra monozonus, 333.
simplex, 450.
tenera, 422, 423.
turbo, 434.
(Chrysallis) ustulata, 479.
virgata, 457.
(Prochilus) virgata, 457.
virgata maxwellsmithi, 457.
(Prochilus) virgata porracea, 457.
virgata pulchrior, 457.
virgata sylvanoides, 457.
(Prochilus) virgata pulchrior, 457.
virginea, 451, 452.
(Eudoxus) virginea, 452.
Helicostylus orbitulus, 418.
Helix, 377, 378.
aegrota, 380, 381.
(Corasia) aegrota, 380.
auriculata, 345, 361.
brunnea, 382.
buschi, 448.
cepoides, 431.
(Helicostyla) cepoides, 431.
cincinniformis, 440.
cincinniformis var. a, 444.
decora, 430.
Helix dimera, 405, 406.
dolium, 431.
florida, 411, 416.
(Cochlogena) florida, 411.
(Cochlogena) florida var. a, 416.
floridus, 411, 413, 416.
fulgens, 401.
(Helicostyla) fulgens, 401.
hydrophana, 409.
(Cochlogena) hydrophana, 409.
infuscata, 387.
jonasi, 446, 447.
jonasi var. β, 405.
lineolata, 381.
listeri, 345.
(Carocolla) listeri, 344.
melanocheila, 382.
(Callicochlias) melanocheila, 382.
melanocheilos lineolata, 382.
(Callicochlias) melanochela, 382.
melanocheylos? lineolata, 381.
mindoroensis, 491.
orbitula, 418.
(Cochlostyla) orbitulus, 418.
pan, 462.
papilionacea, 361.
persimilis, 386.
planulata, 360.
roissyana, 389, 393, 394, 397.
(Callicochlias) roissyana, 394.
roissyana lutea, 391.
roissyana var., 391.
roissyana var. d, 389.
(Bulima) rufogaster, 334.
solida, 398.
tenera, 422, 423, 426, 427.
(Cochlogena) tenera, 422, 427.
turbo, 433.
Hemiaulus, 172.
Hemidiscus, 80, 86.
capillaris, 80.
cuneiformis, 80.
hardmanianus, 80.
inornatus, 80.
janischii, 80.
radiatus, 80.
ventricosus, 80.
Hemiptychus, 9.
hennedyi, Navicula, 8, 97, 98, 104, 109, 111.
henshawii, Amphora, 23, 176.
Hercotheca, 82, 83.
brevispina, 82.
inermis, 82, 178.
mammillaris, 82.
heros, Pleurosigma, 135, 136.
Hesione, 189.
genetta, 189.
Hesionidae, 189.
heteroceros, Biddulphia, 40, 44.
heteroidea, Cocconeis, 62, 63.
heteromorpha, Achnanthes, 11, 60.
heteromorphus, Coscinodiscus, 66.
heteroporum, Triceratium, 167.
Triceratium (Biddulphia), 166, 168.
Trigonium, 167, 169.
hexagona, Achnanthes, 11.
hexagonus, Actinoptychus, 14.

hians, Halicornaria, 199, 237.
  Plumularia, 237.
hibernicus, Campylodiscus, 51.
hiltonianus, Asteromphalus, 30.
hirsutispina, Rhopalocidaris, 275.
hirsutispinus, Cidaris (Discocidaris), 272.
hirtus, Hyalodiscus, 84, 93, 178.
hispida, Melosira, 92.
hispidus, Actinoptychus, 14.
Histocidaris, 245.
  acutispina, 247, 248–249 (fig.), 307, 310.
  elegans, 247, 250, 252–253 (fig.), 307, 310.
  magnifica, 244, 245, 246–247 (fig.), 307, 310.
  misakiensis, 255.
  recurvata, 256.
  sp., 254, 255 (fig.), 307, 310.
hodgsonii, Campylodiscus, 51.
honshuensis, Amphora, 25.
horologium, Actinodiscus, 29.
  Campylodiscus, 52, 54.
horridus, Coscinodiscus, 65.
hospes, Cocconeis, 63.
  Navicula, 104.
huerteli, Diphasia, 199, 218, 241.
humilis, Coscinodiscus, 175.
  Willemoesia, 175.
hyalina, Amphora, 24.
hyalinum, Bacteriastrum, 57.
Hyalodiscus, 58, 83, 84, 93.
  annulus, 83, 178.
  argus, 83.
  aspersus, 83, 178.
  cervinus, 65, 84.
  hirtus, 84, 93, 178.
  laevis, 84.
  maximus, 85.
  propeplanus, 84, 178.
  radiatus, 85.
  stelliger, 85.
  subtilis, 12, 84, 85.
Hyalosira punctata, 141.
hybrida, Surirella, 155.
Hydroida of the Philippine region, 195.
hydrophana, Bulimus, 409.
  Bulimus (Orthostylus), 409.
  Cochlostyla, 409.
  Cochlostyla (Cochlostyla), 407, 408.
  Cochlostyla (Cochlostyla) hydrophana, 408, 409.
  Cochlostyla metaformis, 409.
  Helicostyla, 409.
  Helix, 409.
  Helix (Cochlogena), 409.
hydrophanus, Bulimus, 409.
  Cochlodryas, 409.
Hydrosilicon, 85.
  rimosa, 85.
Hypselostyla (subg.), 435.
Hypselostyla cincinniformis, 441.
Idia pristis, 199, 207, 217.
ilinensis, Obba marmorata, 338, 341, 360.
ilogana, Cochlostyla (Chrysallis) aspersa, 502, 503, 517.
  Helicostyla (Chrysallis) mindoroensis, 531.
  Obba sarcochroa, 355.
imitans, Navicula, 104, 179.
  Surirella, 155, 181.
imitatrix, Mastogloia, 89, 179.
imperator, Branchiocerianthus, 198, 200.
  Monacaulus, 200.
imperialis, Campylodiscus, 50, 52.
impleta, Navicula, 119.
impressa, Biddulphia, 40.
  Navicula, 103, 121.
incanum, Cerion, 454.
incertus, Campylodiscus, 49, 50, 52, 55.
incompta, Melosira, 93, 179.
incurvata, Surirella, 154, 156.
indica, Biddulphia, 41.
  Navicula, 104.
  Stereocidaris, 303.
indigens, Navicula, 105, 179.
inelegans, Biddulphia (Triceratium), 42.
  Trigonium, 169.
inermis, Hercotheca, 82, 178.
  Stephanopyxis turris arctica, 93.
  Triceratium robertsianum, 47.
inexacta, Navicula, 8, 104, 105, 118, 179.
inflata, Achnanthes, 11.
  Amphora, 8, 24.
inflatum, Dimeregramma, 73.
informis, Biddulphia, 41, 177.
infuscata, Helix, 387.
ingens, Navicula, 103, 105, 179.
inglorium, Trigonium, 169.
inhalata, Navicula, 107, 179.
inopinus, Campylodiscus, 52.
inornata, Diphasia, 199, 219, 241.
  Triceratium eulensteinii, 166, 167.
inornatus, Hemidiscus, 80.
insecta, Auricula, 33.
insignis, Biddulphia, 41.
  Cocconeis, 63.
  Craspedodiscus, 71.
  Navicula lyra, 108.
  Nitzschia, 127, 180.
intercedens, Navicula, 7, 107.
  Surirella, 156.
intermedia, Navicula (Diploneis) cynthia, 101.
  Terpsinoe, 160.
intermedium, Pleurosigma, 132.
intermedius, Campylodiscus, 50, 52.
interrupta, Amphora, 24.
  Biddulphia, 44.
intersecta, Amphora, 24, 176.
invenusta, Navicula, 107.
inversa, Biddulphia, 41, 177.
Iphione, 183.
  muricata, 183.
Iphionella elongata, 313, 315 (fig.).
iridis, Navicula, 107, 133.
ishikawai, Halicornaria, 238.
islandica, Grammatophora, 79.
Isthmia, 85.
  capensis, 85.

Isthmia lindigiana, 85.
  minima, 85.
italicum, Pleurosigma, 135.
jamaicensis, Navicula, 123.
Janischia, 170.
janischii, Actinoptychus, 14.
  Coscinodiscus, 67.
  Euodia, 77.
  Hemidiscus, 80.
  Leudugeria, 77, 86.
  Navicula, 108.
  Navicula (marginata), 8.
japonica, Auricula, 33.
  Biddulphia, 35.
  Navicula (Schizonema), 119.
  Surirella, 157.
japonicum, Pleurosigma, 131, 135, 136.
  Triceratium, 35.
japonicus, Stictodiscus, 149.
javanica, Achnanthidium, 12.
  Mastogloia, 90.
  Tropidoneis, 173.
jayi, Cochlostyla (Chrysallis), 476.
  Cochlostyla (Chrysallis) jayi, 476, 478, 479.
jejuna, Navicula, 107.
jelineckiana, Mastogloia, 90.
jenneri, Navicula, 89.
jensenianum, Triceratium, 40.
johnsoni, Cochlostyla (Helicostyla) fulgens, 400, 404.
  Obba mesai, 357, 359.
johnsonianus, Stictodiscus, 162.
johnsonii, Pinnularia, 147.
jonasi, Bulimus, 446.
  Cochlostyla, 447, 448.
  Cochlostyla (Eudoxus), 446, 449.
  Cochlostyla (Phengus), 448.
  Eudoxus, 448.
  Helicostyla, 446–448.
  Helix, 446, 447.
  var. β, Helix, 405.
juani, Cochlostyla (Chrysallis) aspersa, 502, 503, 507.
  Cochlostyla rufogaster, 329, 330.
jugata, Navicula, 96, 107.
juncatensis, Biddulphia, 7, 42.
juncta, Biddulphia, 42.
Keck, Warren, 196.
kerguelensis, Mastogloia, 91.
kincaidi, Diphasia, 220.
kinkeri, Aulacodiscus, 31.
kinkerii, Campylodiscus, 49, 51, 52.
Kirchenpauerinae, 197.
kittonianus, Campylodiscus, 52.
  Stictodiscus, 149.
kittonii, Aulacodiscus, 40.
kossuthii, Stictodiscus, 29.
kuetzingii, Coscinodiscus, 67.
kurzii, Navicula (Alloioneis?), 120.
kutzingii, Coscinodiscus, 67.
labrella, Bulimus, 455.
  Partula, 455, 459.
labuensis, Amphora, 27.
lacrimans, Navicula, 7, 107.
lacunata, Cymatoneis, 72, 178.
Laetmonice, 183.
  nitida, 183, 187 (fig.).
Laetmonice pellucida, 186.
  producta, 183.
laevigatus, Actinoptychus, 15.
laevis, Hyalodiscus, 84.
Lafoea convallaria, 211, 212.
  plicatilis, 204.
Lafoëidae, 199, 209.
Lagenitheca, 198.
lamellata, Stereocidaris sceptriferoides, 304, 305 (fig.), 309–311.
Lampriscus, 40, 169.
lanceolata, Achnanthes, 11.
lanceolatum, Pleurosigma, 135.
larvata, Cochlostyla (Prochilus), 467.
  Cochlostyla (Prochilus) fictilis, 467.
lata, Surirella, 156, 157.
  Tropidoneis, 174.
latecostata, Auliscus caelatus, 7, 32.
latestriata, Scoliopleura, 144.
latum, Pleurosigma, 135.
  Trigonium, 165, 169–171.
latus, Campylodiscus, 48, 52.
lauta, Denticula, 16.
laxa, Surirella, 156.
laymansa, Cochlostyla (Calocochlea) roissyana, 387, 397.
leai, Bulimus, 446, 447.
  Cochlostyla, 447.
  Helicostyla, 447.
Leiocidaris bispinosa, 258.
  pistillaris annulifera, 257.
lemniscata, Mastogloia, 88, 90, 91.
lentiginosus, Coscinodiscus, 67.
Leodicidae, 193.
lepidoptera, Tropidoneis, 174, 175.
lepidus, Campylodiscus, 52.
leptopus, Coscinodiscus, 67.
leudugeri, Mastogloia, 88, 90.
Leudugeria, 80, 86.
  janischii, 77, 86.
  monilifera, 86.
liber, Navicula, 10, 107, 108, 118.
lichenifer, Bulimus, 481.
  Cochlostyla, 481, 487.
  Cochlostyla (Chrysallis), 480.
  Cochlostyla (Chrysallis) lichenifer, 480, 481.
Licmophora, 86, 144, 147.
  debyi, 86, 178.
  ehrenbergii, 86.
  ovata, 86.
Lictorella cervicornis, 212, 213.
lighti, Halecium, 198, 202.
ligulosus, Campylodiscus, 53, 177.
lillianae, Cochlostyla (Halocochlea), 376, 399.
limbatus, Campylodiscus, 53.
limpida, Amphiprora, 16, 176.
  Trinacria, 172, 182.
lindigiana, Isthmia, 85.
lineata, Amphora, 24.
  Campylodiscus concinnus, 8, 50.
  Mastogloia, 90.
lineatus, Coscinodiscus, 67, 68.
lineolata, Helix, 381.
  Helix melanocheilos, 382.
  Helix melanocheylos?, 381.
lineolatum, Triceratium, 40.

listeri, Caracolla, 344.
    Helix, 345.
    Helix (Carocolla), 344.
    Obba, 343–345, 353, 356.
Lithodesmium, 40.
littorale, Pleurosigma, 132.
littoralis, Navicula, 107.
    Nitzschia, 127.
longa, Navicula, 8, 108.
longipes, Achnanthes, 10, 11.
longissima, Grammatophora, 79.
longitheca, Desmoscyphus, 218.
lorenziana, Cistula, 8, 59.
lorenzianum, Chaetoceros, 56.
lorenzianus, Campylodiscus, 49.
lorenzii, Chaetoceros, 56.
    Climaconeis, 148.
lubanensis, Cochlostyla (Hypselostyla) cincinniformis, 436, 444.
    Cochlostyla (Hypselostylus) cincinniformis, 444.
    Helicostyla cincinniformis, 444.
lubangensis, Obba planulata, 361, 362.
lunai, Cochlostyla (Chrysallis) aspersa, 502, 503, 505.
lunaris, Amphora, 24, 176.
lutea, Cochlostyla roissyana, 391.
    Cochlostyla (Calocochlea) roissyana, 387, 391.
    Helicostyla roissyana, 391.
    Helix roissyana, 391.
lyra, Navicula, 96, 104, 108, 119.
Lysidice, 193.
    collaris, 193.
Lytocarpia, 197, 236.
Lytocarpus, 239.
    balei, 199, 236.
    hawaiensis, 234, 235.
    pennarius, 199, 234.
    philippinus, 199, 235.
    phoeniceus, 199, 233.
    secundus, 234.
    spectabilis, 199, 234.
macassarensis, Campylodiscus, 50.
Macellicephala maculosa, 313, 314 (fig.).
macgillivrayi, Aglaophenia, 199, 231.
    Plumularia, 231.
macilenta, Cochlostyla (Chrysallis) antoni, 495, 496.
macra, Cochlostyla (Chrysallis) chrysalidiformis, 470, 472.
macraeana, Surirella, 154, 156, 157, 181, 182.
    Surirella lata, 157.
macraeanus, Aulacodiscus, 31.
macraei, Navicula, 104.
maculata, Podosira, 85.
maculosa, Macellicephala, 313, 314 (fig.).
madagascarense, Triceratium, 42.
madagascarensis, Auliscus oamaruensis, 32.
    Biddulphia, 42.
    Melosira, 93.
    Navicula, 108, 180.
magnifica, Acoetes, 315.
    Amphora, 25, 176.
    Histocidaris, 244, 245, 246–247 (fig.), 307, 310.
magnirostris, Halicornaria, 199, 238, 242.
maita, Cochlostyla (Chrysallis) caniceps, 520, 522, 523.
major, Goniocidaris (Cyrtocidaris) tenuispina, 270, 271 (fig.), 308, 311.
majus, Pleurosigma, 139.
majuscula, Nitzschia, 126, 127.
    Nitzschia fluminensis, 7, 126.
Maldane, 320.
    philippinensis, 313, 320 (fig.).
mammalis, Achnathes, 61.
    Rhaphoneis, 60–62.
mammillaris, Hercotheca, 82.
mangarina, Cochlostyla (Chrysallis) electrica, 483, 484.
    Cochlostyla (Prochilus) fictilis, 466.
    Obba, planulata, 361, 362, 369, 371.
manilana, Cochlostyla rufogaster, 332, 334.
manlaysa, Cochlostyla (Calocochlea) roissyana, 387, 396.
Mann, Albert, on marine diatoms of the Philippine Islands, 1.
mansalayana, Obba planulata, 361, 362, 367, 369.
margarita, Navicula, 7, 108.
margaritacea, Glyphodesmis, 78.
margaritaceus, Aulacodiscus, 31.
margaritifera, Endictya, 75, 178.
margaritiferum, Trigonium, 162.
marginata, Campanularia, 203, 211.
    Navicula, 8, 100, 108, 123.
marginatus, Coscinodiscus, 67.
    Thyroscyphus, 198, 203.
marginulata, Nitzschia, 127.
marina, Denticula, 73.
    Grammatophora, 79.
marinum, Pleurosigma, 135.
marmorata, Obba, 329, 337, 338, 343.
    Obba marmorata, 338, 339.
    Obbina planulata, 339.
martensianus, Plagiodiscus, 157.
marylandica, Asterolampra, 29.
marylandicum, Triceratium, 14.
masalacensis, Nereis, 189, 191 (fig.).
Mastogloia, 86, 89, 90, 92, 95, 108, 123, 147, 148.
    achnanthioides, 87, 178.
    affirmata, 87.
    albifrons, 90.
    angulata, 87.
    capax, 87, 179.
    cebuensis, 88, 179.
    cocconeiformis, 88.
    concinna, 91.
    constricta, 87.
    cruciata, 88.
    egregia, 88.
    elegans, 88.
    elongata, 91.
    exarata, 90.
    fallax, 87.
    fusiformis, 88, 179.
    gruendleri, 89.
    grundleri, 7.
    grunowii, 91.

Mastogloia imitatrix, 89, 179.
  javanica, 90.
  jelineckiana, 90.
  kerguelensis, 91.
  lemniscata, 88, 90, 91.
  leudugeri, 88, 90.
  lineata, 90.
  mauritiana, 91.
  obscura, 91.
  oculiformis, 90.
  ovata, 90, 179.
  ovum-paschale, 90.
  pulchella, 91.
  quinquecostata, 91, 179.
  rhombus, 8, 91.
  sansibarica, 91, 92.
  seriata, 92.
  sinuata, 91, 92.
  splendida, 92.
  squamosa, 92.
Mastoneis, 95.
mateoi, Cochlostyla (Cochlodryas), 422, 423, 429.
  Cochlostyla (Cochlodryas) mateoi, 422, 426.
mateoi subsp., Cochlostyla (Cochlodryas), 426.
mauritiana, Mastogloia, 91.
maxima, Navicula, 107, 108.
  Navicula liber, 109.
  Tropidoneis, 174.
maximus, Hyalodiscus, 85.
maxwellsmithi, Helicostyla virgata, 457.
mayabigana, Obba listeri, 345, 348, 350.
mccoyi, Aglaophenia, 232.
mcgintyi, Helicostyla, 486.
Mearns, Edgar A., 376.
medioensis, Obba planulata, 361, 362, 368.
mediterranea, Navicula, 101.
mediterraneana, Melosira, 94.
mediterraneanum, Skeletonema, 145.
medusa, Chaetoceros (Bacteriastrum), 57, 58, 177.
medusiformis, Stegopoma, 205, 206.
melanocheila, Callicochlias, 382.
  Cochlostyla, 382.
  Cochlostyla (Calocochlea), 381, 385.
  Helix, 382.
  Helix (Callicochlias), 382.
melanochela, Helix (Callicochlias), 382.
melanochila, Cochlostyla, 382.
  Cochlostyla (Callicochlias), 382.
  Helicostyla, 382, 388.
  Helicostyla (Calocochlea), 382.
melanogaster, Chrysallis, 510.
  Cochlostyla, 510.
  Cochlostyla aspersa, 502, 503.
  Cochlostyla (Chrysallis) aspersa, 517.
  Cochlostyla mindoroensis, 510.
Melosira, 58, 76, 92, 93, 145.
  biseriata, 93.
  coronaria, 92.
  dura, 92, 179.
  gowenii, 93, 179.
  hispida, 92.
  incompta, 93, 179.
Melosira madagascarensis, 93.
  mediterraneana, 94.
  setosa, 92.
  undulata, 93.
membranacea, Amphiprora, 173.
  Biddulphia, 42.
  Tropidoneis, 174.
membranaceum, Trigonium, 42, 170.
membraneacea, Tropidoneis, 173.
Menage Expedition, 375.
menagei, Cochlostyla (Hypselostyla) cinciniformis, 436, 439.
  Cochlostyla (Hypselostylus) cincinniformis, 439.
mendica, Navicula, 109, 110, 179.
mesai, Obba, 343, 354, 356–358.
  Obba mesai, 357, 358, 360.
metaformis, Cochlostyla, 378, 409.
  Cochlostyla (Cochlostyla), 407.
  Cochlostyla (Dryocochlias), 409.
metularia, Cidaris, 260.
  Eucidaris, 260.
mexicana, Caloneis, 110.
  Navicula, 110.
  Surirella, 157.
micans, Coscinodiscus, 68, 69.
Michael, E. L., 1.
micropora, Trigonium inelegans, 169.
microscopica, Plumularia, 227.
microtuberculata, Cidaris (Stereocidaris), 302.
  Stereocidaris, 300, 302, 309.
mikado, Discocidaris, 277.
  Goniocidaris (Discocidaris), 262, 264.
milesiana, Amphora, 25.
mimula, Navicula, 109, 110, 179.
Mindoro Province, land shells of the genus Obba from, 343.
  tree snails of the genus Cochlostyla from, 373.
mindoroensis, Bulimus, 501, 505, 508, 510, 512.
  Bulinus, 501, 505, 508, 510, 512.
  Chrysallis, 505, 508, 510, 512.
  Cochlostyla, 475, 488, 500, 501, 505, 508, 510, 512.
  Cochlostyla (Chrysallis) aspersa, 455, 501, 503, 505, 508.
  Helicostyla, 505, 508, 510, 512.
  Helicostyla (Chrysallis), 503, 507, 510.
  Helix, 491.
  var. k, Bulinus, 483.
minima, Isthmia, 85.
minor, Endictya, 76.
  Obba listeri, 345, 348.
minor, Obbina listeri, 348.
minus, Dimeregramma, 74.
minuta, Cochlostyla (Chrysallis) caniceps, 520, 527.
  Sertularia, 213.
mirabile, Skeletonema, 145.
mirabilis, Calvinia, 230.
  Cochlostyla, 378.
  Cochlostyla (Helicostyla), 400.
  Navicula, 110.
  Sertularella, 199, 216, 241.

mirificum, Rhabdonema, 141.
misakiensis, Histocidaris, 255.
mobiliensis, Biddulphia, 42.
moelleri, Actinoptychus, 15.
molesta, Navicula, 110, 179.
Möllendorff, O. F. von, 375.
mollis, Surirella, 156, 158.
Mollusks, Cochlostyla rufogaster and Obba marmorata and their races, 329.
Mollusks of genus Cochlostyla of Mindoro Province, 373.
Mollusks of the genus Obba from Mindoro Province, 343.
Mollusks of the genus Opisthoporus, 323.
Monacaulus imperator, 200.
monacha, Cochlostyla (Calocochlea) roissyana, 387.
  Helicostyla (Calocochlea) roissyana, 387.
monilifera, Amphora, 25.
  Epithemia, 86.
  Leudugeria, 86.
moniligera, Climacosphenia, 8, 59, 60.
Monopoma, 196.
Monorchos, 190.
  philippinensis, 191 (fig.).
Monotheca, 230.
monozona, Cochlostyla, 333.
  Cochlostyla rufogaster, 332, 334, 335.
  Orthostylus, 333.
monozonus, Bulimus, 332, 333.
  Cochlostyla, 333.
  Helicostyla rufogastra, 333.
  Orthostyla, 333.
montalbana, Cochlostyla rufogaster, 330, 331, 334, 336.
Mortensen, Theodor, on Echinoidea—The Cidaridae, 243.
Moseley, E. L., 375.
Mucronalia, 258.
muelleri, Campylodiscus, 7, 53.
multicostata, Navicula, 7, 99, 111.
  Surirella, 151.
multifurcatus, Stictodiscus, 149.
multiplex, Stictodiscus, 149, 166.
  Triceratium, 166, 167.
  Trigonium, 167, 170.
munifica, Allonitzschia, 16, 176.
muricata, Iphione, 183.
murrayana, Glyphodesmis, 131.
  Plagiogramma, 131.
musca, Navicula, 107.
musica, Terpsinoe, 160.
my, Navicula, 123.
nana, Cochlostyla calobapta, 465.
Nanina dolium, 431.
nankoorense, Plagiogramma, 130.
nankoorensis, Stictodiscus, 149.
nano-lineatus, Coscinodiscus, 68, 178.
nanum, Dimeregramma, 74.
Navicula, 2, 10, 59, 71, 72, 89, 90, 94, 95, 96, 99, 105, 109, 112, 113, 115, 119, 121, 123, 124, 144, 147, 148, 175.
Navicula (Stauroneis), 62.
Navicula abrupta, 94.
  acrosphaeria, 94.
Navicula adonis, 122.
  aestiva, 94, 106, 120, 121.
  affirmata, 92.
  ambigua, 89.
  angulosa, 94.
  antillarum, 94.
  approximata, 7, 8, 94, 104.
  approximata substauroneiformis, 7, 94.
  approximata substauroniformis, 7.
  arctica, 96.
  aspera, 95.
  barbitos, 95.
  bartholomei, 100.
  belgica, 123.
  beyrichiana, 95.
  biclavata, 95.
  biformis, 95, 179.
  bigemmata, 95, 107, 179.
  biseriata, 109, 110.
  bleischiana, 96.
  bleischii, 96.
  bomboides, 96.
  bottnica, 110.
  branchiata, 96, 179.
  brasiliensis, 97.
  bullata, 97, 101.
  caeca, 97, 179.
  californica, 97, 98, 109.
  californica campechiana, 7, 97.
  caliginosa, 100.
  campylodiscus, 8, 97.
  cancellata, 103, 122.
  cancellata gregorii, 103.
  caribaea, 97, 115.
  carinifera, 7, 95, 96, 98, 175.
  castracanei, 98.
  chersonensis, 8, 98.
  circumsecta, 98.
  clavata, 98, 99, 104.
  clavigera, 95.
  clepsydra, 98.
  cluthensis, 101.
  coarctata, 7, 98, 113, 114.
  consors, 98.
  contigua, 101.
  corpulenta, 99, 179.
  crabro, 95, 99, 105, 111, 113, 114, 120, 121.
  crucifix, 119.
  cuspidata, 89, 99, 147.
  cyclops, 99, 179.
  (Diploneis) cynthia intermedia, 101.
  delecta, 100, 180.
  didyma, 101.
  diffusa, 8, 101.
  digito-radiata, 111.
  diplosticta, 101.
  diversa, 125.
  durandii, 101, 179.
  egeria, 91.
  elliptica, 121.
  elongata, 101.
  erythraea, 101.
  eudoxia, 101.
  excavata, 8, 102, 113, 115, 179.
  exempta, 113.
  eximia, 102.

Navicula expedita, 102.
  forcipata, 102, 111.
  forcipata densestriata, 102.
  forcipata densistriata, 8.
  formicina, 7, 102.
  funiculata, 102, 179.
  fusca, 103, 106, 114, 121.
  gemmata, 103, 116.
  gemmata peristiophora, 103.
  gemmatula, 95, 103, 107.
  glabrissima, 103, 179.
  graeffii, 8, 103, 179.
  gregorii, 103.
  grevillei, 128.
  (Alloioneis) gruendleri, 104.
  grundleri, 105.
  (Alloioneis) grundleri, 118.
  hamulifera, 104.
  hennedyi, 8, 97, 98, 104, 109, 111.
  hospes, 104.
  imitans, 104, 179.
  impleta, 119.
  impressa, 103, 121.
  indica, 104.
  indigens, 105, 179.
  inexacta, 8, 104, 105, 118, 179.
  ingens, 103, 105, 179.
  inhalata, 107, 179.
  inhalata biharensis, 107.
  intercedens, 7, 107.
  invenusta, 107.
  iridis, 107, 133.
  jamaicensis, 123.
  janischii, 108.
  (marginata) janischii, 8.
  (Schizonema) japonica, 119.
  jejuna, 107.
  jenneri, 89.
  jugata, 96, 107.
  (Alloioneis?) kurzii, 120.
  lacrimans, 7, 107.
  lacrimans fossilis, 107.
  liber, 10, 107, 108, 118.
  liber maxima, 109.
  littoralis, 107.
  longa, 8, 108.
  lyra, 96, 104, 108, 119.
  lyra elliptica, 108.
  lyra insignis, 108.
  lyra recta, 108.
  macraei, 104.
  madagascarensis, 108, 180.
  margarita, 7, 108.
  marginata, 8, 100, 108, 123.
  maxima, 107, 108.
  mediterranea, 101.
  mendica, 109, 110, 179.
  mexicana, 110.
  mimula, 109, 110, 179.
  mirabilis, 110.
  molesta, 110, 179.
  multicostata, 7, 99, 111.
  musca, 107.
  my, 123.
  nebulosa, 111.
  nitescens, 109, 111, 124.
  notabilis, 111.
  nummularia, 111.
Navicula oamaruensis, 111.
  obesa, 62, 111, 179, 180.
  ocellata, 112, 180.
  ophiocephala, 112.
  oscitans, 112.
  oscitans suboscitans, 112.
  o'swaldii, 113.
  ovulum, 107.
  pacifica, 113.
  pandura, 97, 99, 105, 113.
  parallela, 115, 116.
  partita, 113, 180.
  patricia, 114, 180.
  pelagi, 7, 114.
  pensacola, 96.
  petitiana, 114.
  philippinarum, 114, 180.
  philippinica, 110.
  pinguis, 115.
  platessa, 123.
  plicatula, 115, 116, 180.
  polysticta, 98.
  powellii, 100.
  praetexta, 116.
  pristiophora, 116.
  probabilis, 7, 116.
  prodiga, 116.
  pseudo-clavata, 116, 180.
  pudens, 7, 117, 180.
  puella, 8, 117.
  pugio, 117, 180.
  pulverulenta, 117, 180.
  raeana, 118.
  rectangulata, 118.
  retinenda, 118.
  retrostauros, 118, 180.
  rhombica, 119.
  richardsoniana, 109.
  robusta, 119.
  samoensis, 119.
  scopulorum, 147, 148.
  seductilis, 119.
  sejuncta, 117.
  semistauros, 119, 180.
  separabilis, 8, 99, 120.
  serratula, 120, 180.
  serrulata, 7.
  simulator, 120, 180.
  smithii, 106, 121.
  solaris, 111.
  spectabilis, 107, 121, 180.
  spiculifera, 121, 180.
  splendida, 98, 117, 122.
  splendida var., 7.
  (Pseudo-Amphiprora) stauroptera, 96.
  strangulata, 100, 123.
  subacuta, 122.
  subfusca oamaruensis, 106.
  suboscitans, 112, 122.
  (oscitans var.?) subundulata, 122.
  suffocata, 122, 180.
  sulcata, 122.
  tabellaria, 94.
  (Dictyoneis) thumii, 123.
  transfuga, 116.
  translucens, 123, 180.
  tumida, 89.

Navicula turgescens, 123.
  vacillans, 124.
  vaszaryi, 12.
  velata, 124.
  venusta, 124, 180.
  vespa, 124.
  vesparella, 124, 180.
  vulpecula, 124.
  weissflogii, 8, 125, 180.
  yarrensis, 118, 125.
  zostereti, 125.
naviculaceum, Pleurosigma, 135.
nebulosa, Navicula, 111.
nebulosus, Actinocyclus, 12, 13.
neglecta, Hebella, 198, 208.
Nemertesia cylindrica, 199, 227.
neogradense, Triceratium, 14.
Nereidae, 189.
Nereis, 189.
  masalacensis, 189, 191 (fig.).
nervatus, Plagiodiscus, 157.
nicobarica, Nitzschia, 125, 126.
nicobaricum, Pleurosigma, 135.
Nigella, 198.
Nigellastrum, 220.
niger, Cochlostyla (Chrysallis) rollei, 491.
nigra, Cochlostyla (Chrysallis) rollei, 488, 489, 491.
nigriceps, Cochlostyla (Chrysallis), 526–528.
  Cochlostyla (Chrysallis) nigriceps, 528, 529.
nigrocincta, Cochlostyla, 462.
nitescens, Navicula, 109, 111, 124.
nitida, Laetmonice, 183, 187 (fig.).
nitidulus, Coscinodiscus, 8, 68.
nitidus, Coscinodiscus, 69.
  Stictodiscus, 150, 181.
Nitzschia, 17, 125, 126.
  alata, 125, 126.
  bisculpta, 125, 180.
  bukensis, 126.
  campechiana, 8, 125, 126, 128, 180.
  cocconeiformis, 126, 180.
  distans, 126.
  distans tumescens, 8, 126.
  fluminensis, 8, 126, 127.
  fluminensis majuscula, 7, 126.
  graeffei, 127.
  granulata, 127.
  granulosa, 127.
  insignis, 127, 180.
  littoralis, 127.
  majuscula, 126, 127.
  marginulata, 127.
  marginulata subconstricta, 8, 127.
  nicobarica, 125, 126.
  obesa, 127.
  ocellata, 17.
  panduriformis, 125, 127.
  plana, 129.
  plana zebuana, 129.
  pulcherrima, 8, 128.
  salinarum, 128.
  spathulata, 128.
  superba, 126, 128.
Nitzschia tryblionella, 128.
  tubicola, 128.
  valida, 8, 128.
  valida var., 8.
  vermiculata, 128.
  weissflogi(i), 7, 128, 180.
  zebuana, 129, 180.
nobilis, Coscinodiscus, 69.
nodosa, Amphora, 25, 176.
  Pasythea, 220.
nodulifer, Coscinodiscus, 69.
noricus, Campylodiscus, 51.
normani, Acryptolaria, 199, 208, 209, 241.
normanii, Coscinodiscus, 69.
  Pleurosigma, 133, 136.
notabilis, Navicula, 111.
nubifer, Cochlostyla (Chrysallis) nigriceps, 528, 530.
nummularia, Navicula, 111.
Nutting, Charles C., on Hydroida of the Philippine region, 195.
nympha, Cochlostyla (Hypselostyla), 435.
oamaruensis, Biddulphia, 36.
  Navicula, 111.
  Navicula subfusca, 106.
Obba, 343, 352, 355, 361.
  gallinula, 343.
  gallinula barthelowi, 343.
  gallinula pagbilaoensis, 344.
  listeri, 343–345, 353, 356.
  listeri caloocana, 345, 353, 354.
  listeri campoensis, 345, 347, 349, 351.
  listeri halcona, 345, 348.
  listeri mayabigana, 345, 348, 350.
  listeri minor, 345, 348.
  listeri recurvata, 345, 351.
  listeri scalaris, 351, 353.
  listeri sibolonensis, 345, 346.
  listeri smithi, 345, 351.
  listeri subplanulata, 345, 353, 354.
  marmorata, 329, 337, 338, 343.
  marmorata benguetana, 338, 339.
  marmorata bolinaoana, 338, 339.
  marmorata ecijana, 338, 340, 341.
  marmorata ilinensis, 338, 341, 360.
  marmorata marmorata, 338, 339.
  marmorata rizalana, 338, 340.
  mesai, 343, 354, 356–358.
  mesai johnsoni, 357, 359.
  mesai mesai, 357, 358, 360.
  mesai richi, 357, 358.
  mesai sablayana, 357, 358.
  planulata, 343, 356, 360.
  planulata bongabona, 361, 364, 367.
  planulata cagurayana, 361, 362, 370, 371.
  planulata lubangensis, 361, 362.
  planulata mangarina, 361, 362, 369, 371.
  planulata mansalayana, 361, 362, 367, 369.
  planulata medioensis, 361, 362, 368.
  planulata paluana, 361, 365.
  planulata salcedoi, 361, 364.

Obba planulata varaderoana, 361, 363, 365.
  planulata verdensis, 361, 362, 370.
  sarcochroa, 343.
  sarcochroa ilogana, 355.
  sarcochroa sarcochroa, 356.
  subhorizontalis, 343, 355.
  subhorizontalis radcliffei, 355.
  subhorizontalis subhorizontalis, 355.
Obbina listeri minor, 348.
  listeri recurvata, 351.
  listeri recurvata subscalaris, 351, 353.
  planulata, 338.
  planulata marmorata, 339.
Obelia serrulata, 202.
  thornelyi, 198, 202.
obesa, Amphora, 25.
  Navicula, 62, 111, 179, 180.
  Nitzschia, 127.
  Stauroneis, 62, 111.
obesum, Plagiogramma, 130.
  Pleurosigma, 131, 136, 181.
oblonga, Tropidoneis, 174.
oblongistriata, Surirella ceylanensis, 151.
obnubila, Cochlostyla (Chrysallis) nigriceps, 528, 530.
obscura, Mastogloia, 91.
obscurus, Actinocyclus, 13.
obtusa, Amphora, 22, 25.
obtusum, Pleurosigma, 136, 137, 181.
oceanica, Amphora obtusa, 25.
  Endictya, 76, 77.
  Grammatophora, 79.
oceanicum, Rhoicosigma, 143.
ocellata, Amphora, 25.
  Cocconeis, 63, 178.
  Navicula, 112, 180.
  Nitzschia, 17.
oculiformis, Mastogloia, 90.
oculus, Amphora, 25.
oculus-cati, Cocconeis, 63.
oculus-iridis, Coscinodiscus, 65, 69.
Odontella, 81.
Okedenia, 148.
  scopulorum, 148.
omphalanthus, Coscinodiscus, 65.
Omphalopsis, 129.
  australis, 129.
Onuphis branchiata, 313, 317, 318 (fig.).
  (Nothria) willemoesii, 319.
Ophiacantha sp., 270.
ophiocephala, Navicula, 112.
Opisthoporus, 323, 324 (fig.).
  biciliatus, 323, 327.
  quadrasi, 323–325.
  quadrasi busuangensis, 325.
  quadrasi palawanensis, 323, 326, 327.
  quadrasi quadrasi, 324, 325, 327.
  quadrasi subsp., 327.
  quadrasi turturinganus, 325, 326.
opulens, Dimeregramma, 74, 178.
orbicularis, Campylodiscus, 52.
orbitula, Bulimus, 418.
  Cochlostyla, 418, 419.
  Cochlostyla (Cochlodryas), 418.
  Helicostyla, 418, 419.
orbitula, Helix, 418.
orbitulus, Cochlostyla, 419.
  Helicostylus, 418.
  Helix (Cochlostyla), 418.
oregonus, Aulacodiscus, 31.
orientalis, Aulacodiscus, 31.
  Surirella, 156, 182.
ornatus, Campylodiscus, 48, 53.
orotis, Helicostyla (Chrysallis) mindoroensis, 486.
Orthoneis, 87, 92.
Orthosira, 76.
  aspera, 90.
Orthostyla monozonus, 333.
  rufogaster, 334, 335.
Orthostylus (subg.), 434.
Orthostylus, 377, 378.
  floridus, 411.
  monozona, 333.
  rufogaster, 334.
Orthotropis, 173.
osborni, Cochlostyla (Chrysallis) rollei, 488, 489.
oscitans, Navicula, 112.
os-pristis, Cocconeis, 63, 178.
ostrea, Auricula, 33.
Oswaldella, 197.
o'swaldii, Amphiprora, 17, 176.
  Navicula, 113.
ovalis, Amphora, 25.
ovata, Licmophora, 86.
  Mastogloia, 90, 179.
ovulum, Navicula, 107.
ovum-paschale, Mastogloia, 90.
Pachya dolium, 431.
pacifica, Antennopsis, 199, 228, 241.
  Navicula, 113.
  Surirella, 157.
pagbilaoensis, Obba gallinula, 344.
palawanensis, Opisthoporus quadrasi, 323, 326, 327.
palliobasis, Cochlostyla (Chrysallis), 486.
Palmeria, 80.
paluana, Obba planulata, 361, 365.
paludosa, Amphiprora, 17.
pan, Bulimus, 462.
  Helix, 462.
pandura, Navicula, 97, 99, 105, 113.
panduriformis, Nitzschia, 125, 127.
papilio, Plagiogramma, 130.
papilionacea, Helix, 361.
papillata, Biddulphia, 43.
parallaxis, Helicostyla (Chrysallis) mindoroensis, 517, 518.
parallela, Navicula, 115, 116.
parallelus, Stictodiscus, 150.
pardus, Trigonium, 170.
partistriata, Scoliopleura, 144, 181.
partita, Navicula, 113, 180.
partitum, Triceratium, 42.
Partula labrella, 455, 459.
partuloides, Bulimus, 462.
  Bulimus (Amphidromus), 462.
  Bulinus, 462.
  Cochlostyla, 462.
  Cochlostyla (Prochilus), 462.
  Helicostyla (Prochilus), 462.

partuloides, Prochilus, 462.
parvus, Actinoptychus, 15, 176.
Pasya, 198.
Pasythea griffini, 221.
  nodosa, 220.
  philippina, 221.
  quadridentata, 199, 220.
  sp., 220.
patens, Surirella, 157.
patricia, Navicula, 114, 180.
pauca, Amphora, 25, 176.
pauperculum, Triceratium, 173.
pecten, Amphora, 26.
peisonis, Scoliopleura, 90.
pelagi, Navicula, 7, 114.
pelagica, Amphiprora, 17.
pellucida, Amphora, 27.
  Cocconeis, 61, 64.
  Laetmonice, 186.
  Tribrachia, 161, 182.
peltata, Goniocidaris (Discocidaris), 244, 261, 262 (fig.), 307, 310, 311.
pennaeformis, Achnanthes, 175.
pennaria, Sertularia, 234.
pennarius, Lytocarpus, 199, 234.
pensacola, Navicula, 96.
pentacrinus, Biddulphia, 43, 45.
pentecrinus, Biddulphia, 8.
peracuta, Cerion, 455.
peristiophora, Navicula gemmata, 103.
permagna, Amphora, 26.
perpallida, Cochlostyla (Calocochlea), 381, 384.
perpusilla, Cochlostyla (Chrysallis) jayi, 476, 478.
persimilis, Helix, 386.
perspicuus, Campylodiscus, 53, 177.
perturbator, Cochlostyla (Chrysallis), 531.
Petalocidaris, 264, 272.
petiti, Cochlostyla (Chrysallis), 487.
petitiana, Biddulphia, 43, 177.
  Navicula, 114.
petitianum, Triceratium, 43.
petitii, Biddulphia, 43, 44, 177.
pettiti, Cochlostyla (Chrysallis), 487.
pfitzeri, Campylodiscus, 52, 54.
phalangium, Campylodiscus, 7, 54.
phantasma, Tropidoneis, 174, 182.
Phengus simplex, 450.
philippina, Aglaophenia, 235.
  Pasythea, 221.
philippinarum, Auliscus, 32, 176.
  Campylodiscus, 53.
  Navicula, 114, 180.
  Rutilaria, 143.
philippinensis, Maldane, 313, 320 (fig.)
  Monorchos, 191 (fig.).
  Sertularella, 199, 217.
philippinica, Amphora, 24.
  Navicula, 110.
philippinus, Lytocarpus, 199, 235.
phoenicea, Plumularia, 233.
phoeniceus, Aglaophenia, 233.
  Lytocarpus, 199, 233.
Phyllacanthus annulifera, 257, 258.
  verticillata, 260.
Pilsbry, H. A., 378, 379.
pinguis, Navicula, 115.
pinnata, Cocconeis, 64.
Pinnularia apiculata, 103.
  johnsonii, 147.
pithogaster, Cochlostyla (Orthostylus), 434, 435.
  Helicostyla (Orthostylus), 434.
Plagiodiscus martensianus, 157.
  nervatus, 157.
Plagiogramma, 77, 129, 131.
  antillarum, 129, 181.
  approximatum, 129, 131.
  atomus, 130.
  attenuatum, 129, 181.
  ceylanense, 130.
  constrictum, 130.
  distinctum, 130, 181.
  gregorianum, 130.
  gregorianum robusta, 130.
  murrayana, 131.
  nankoorense, 130.
  obesum, 130.
  papilio, 130.
  polygibbum, 129, 131.
  quadrigibbum, 131.
  sulcatum, 131.
  tesselatum, 77, 131.
  truanii, 129.
  validum, 77.
  van huerckii, 41.
Plagiotropis, 173.
plana, Nitzschia, 129.
planulata, Helix, 360.
  Obba, 343, 356, 360.
  Obbina, 338.
platessa, Diploneis, 123.
  Navicula, 123.
plenum, Trigonium, 162.
Pleurosigma, 9, 74, 131, 132, 133, 138, 142.
  acus, 132, 181.
  affine, 133, 136.
  angulatum, 9, 132–134, 136, 137, 139.
  balticum, 132, 133, 138.
  decorum, 134, 139.
  dolosum, 133, 181.
  elegantissimum, 133.
  elongatum, 134.
  exemptum, 134, 137, 181.
  falx, 134, 181.
  formosum, 132, 135.
  hamuliferum, 135.
  heros, 135, 136.
  intermedium, 132.
  italicum, 135.
  japonicum, 131, 135, 136.
  lanceolatum, 135.
  latum, 135.
  littorale, 132.
  majus, 139.
  marinum, 135.
  naviculaceum, 135.
  nicobaricum, 135.
  normanii, 133, 136.
  obesum, 131, 136, 181.
  obtusum, 136, 137, 181.
  prisma, 137, 181.

Pleurosigma quadratum, 133.
  rhombeum, 138.
  rigens, 138, 181.
  rigidum, 138.
  robustum, 136.
  simile, 138.
  speciosum, 139.
  strigosum, 139.
  subrigidum, 139.
  suluense, 139, 181.
  transversale, 135.
  virginicum, 133.
plicata, Amphiprora, 17.
plicatile, Stegopoma, 195, 198, 204.
plicatilis, Calycella, 204.
  Lafoea, 204.
plicatula, Navicula, 115, 116, 180.
Plococidaris, 260.
  verticillata, 260.
Plumella, 197.
Plumularia, 226.
  aglaophenoides, 199, 222, 224, 241.
  asymmetrica, 226.
  buskii, 199, 221.
  camarata, 199, 225, 241.
  catharina, 224.
  cylindrica, 228.
  dendritica, 199, 223, 224, 226.
  divaricata, 232.
  effusa, 229.
  flabellata, 199, 223, 241.
  hargitti, 199, 224, 241.
  hians, 237.
  macgillivrayi, 231.
  microscopica, 227.
  phoenicea, 233.
Plumularidae, 196, 197, 199, 200, 221.
Plumularinae, 197.
Podocystis, 140.
  adriatica, 140.
  americana, 140.
  australica, 140.
  spathulata, 140.
Podosira, 83.
  maculata, 85.
Polychaetous annelids, additions to, including one new genus and three new species, 183.
  four new species, 313.
polychroa, Cochlostyla (Cochlodryas), 410.
polygibbum, Plagiogramma, 129, 131.
polymorpha, Biddulphia, 58.
  Clavicula, 59.
Polymyxus, 14.
  coronalis, 14.
  schleinitzii, 14.
Polynoidae, 183.
polysticta, Navicula, 98.
polyzonata, Amphora, 26.
polyzonias, Sertularella, 216.
Porocidaris elegans, 250.
Porpeia, 140.
  quadriceps, 140.
porracea, Cochlostyla, 457.
  Cochlostyla dryas, 457.
  Cochlostyla virgata, 457.
  Helicostyla, 457.
porracea, Helicostyla (Prochilus) virgata, 457.
porraceus, Bulimus, 455, 458.
portuosum, Triceratium, 166.
powellii, Navicula, 100.
praetexta, Navicula, 116.
praetextus, Coscinodiscus, 69.
praevalida, Amphora, 19, 26.
pretiosus, Aulacodiscus, 31, 176.
princeps, Asterolampra, 29.
  Bacteriastrum varians, 57.
  Chaetoceros (Bacteriastrum), 57, 177.
Prionocidaris, 256.
  baculosa, 258.
  baculosa annulifera, 257, 259, 307.
  bispinosa, 258, 307.
  bispinosa chinensis, 259.
  glandulosa, 256.
  verticillata, 260.
prisma, Pleurosigma, 137, 181.
prismatica, Amphora, 26.
prismaticum, Dimeregramma, 74, 178.
pristiophora, Navicula, 116.
pristis, Idia, 199, 207, 217.
probabilis, Navicula, 7, 116.
probata, Grammatophora, 79, 178.
Prochilus (subg.), 454.
Prochilus calobapta, 457.
  calobaptus, 456.
  dryas, 456.
  partuloides, 462.
  virgata, 456.
  virgatus, 456.
prodiga, Navicula, 116.
producta, Laetmonice, 183.
propeplanus, Hyalodiscus, 84, 178.
proteus, Amphora, 26, 27.
pruinosus, Actinocyclus, 13.
Pseudo-Amphiprora, 96.
Pseudo-Auliscus, 146.
pseudo-clavata, Navicula, 116, 180.
Pseudo-Eunotia, 140.
  doliolus, 140, 181.
pseudomarginata, Cocconeis, 64.
Pseudo-Stictodiscus, 168.
  angulatus, 168.
Pseudo-Synedra, 86.
Pseudotriceratium, 162.
Psilocidaris, 244, 282, 285.
  echinulata, 283, 284 (fig.), 308, 310, 311.
Ptychostylus cepoides, 431.
pudens, Navicula, 7, 117, 180.
puella, Navicula, 8, 117.
pugio, Navicula, 117.
pulchella, Acryptolaria, 199, 210.
  Biddulphia, 44, 80, 81.
  Cryptolaria, 210.
  Mastogloia, 91.
  Triceratium cornutum, 44.
pulchellum, Triceratium, 44.
pulcherrima, Cochlostyla (Calocochlea), 381.
  Nitzschia, 8, 128.
  Synedra, 159, 182.
pulchra, Amphora, 26, 176.
  Rutilaria, 143.

pulchrior, Cochlostyla (Prochilus), 458.
  Cochlostyla virgata, 457.
  Helicostyla virgata, 457.
  Helicostyla (Prochilus) virgata, 457.
pulverulenta, Navicula, 117, 180.
punctata, Biddulphia, 44, 48.
  Grammatophora, 79.
  Hyalosira, 141.
punctatum, Trigonium, 169–171.
punctulatus, Actinocyclus, 12, 13.
  Campylodiscus, 7, 54.
pustulatus, Coscinodiscus, 69.
Pycnotheca, 197.
pygmaea, Biddulphia, 44.
Pyxidicula, 76.
Quadras, J. F., 375.
quadrasi, Amphidromus, 500.
  Opisthoporus, 323–325.
  Opisthoporus quadrasi, 324, 325, 327.
quadrasi subsp., Opisthoporus, 327.
quadratum, Pleurosigma, 133.
quadratus, Auliscus, 33, 177.
quadriceps, Porpeia, 140.
quadridens, Thuiaria, 199, 214.
quadridentata, Pasythea, 199, 220.
quadridentata, Sertularia, 220.
quadrigibbum, Plagiogramma, 131.
quadrilateralis, Thuiaria, 214.
quinquecostata, Mastogloia, 91, 179.
quinquelobata, Amphipentas, 34.
quinquelobatum, Trigonium, 171.
rabenhorstianus, Campylodiscus, 8, 54.
radcliffei, Obba subhorizontalis, 355.
radfordianum, Trigonium, 150, 171.
radfordianus, Stictodiscus, 150, 166, 167.
radiata, Biddulphia, 44.
  Rutilaria, 144.
radiatus, Coscinodiscus, 69.
  Hemidiscus, 80.
  Hyalodiscus, 85.
  Stictodiscus, 150.
  Zygoceros, 161.
radiolatum, Trigonium (Triceratium), 171.
radiolatus, Cestodiscus, 171.
radio-punctatum, Triceratium, 42.
radiosus, Coscinodiscus, 68, 69.
raeana, Navicula, 118.
ralfsii, Campylodiscus, 50, 54.
ramosa, Aglaophenia, 232.
rarior, Cochlostyla (Chrysallis) chrysalidiformis, 470, 473.
rattrayanus, Campylodiscus, 8, 54.
recedens, Aulacodiscus, 31, 176.
  Surirella, 157.
recessa, Amphora, 27, 176.
recta, Antennella, 199, 227, 241.
  Navicula lyra, 108.
rectangularis, Amphora, 27.
rectangulata, Navicula, 118.
recurvata, Histocidaris, 256.
  Obba listeri, 345, 351.
  Obbina listeri, 351.
regalis, Campyloneis, 55.
regina, Trinacria, 172.
reini, Cidaris (Cidaris), 292.
reini, Cidaris (Dorocidaris), 292.
  Dorocidaris, 292.
  Stylocidaris, 292, 294 (fig.), 299, 309.
  Tretocidaris, 292.
reniformis, Coscinodiscus, 69, 150, 151.
  Surirella, 70, 151, 157.
reticulata, Biddulphia, 38, 45.
  Donkinia, 75.
reticulatus, Asteromphalus, 30.
  Auliscus, 33.
reticulum, Trigonium, 171.
retiformis, Biddulphia, 45, 177.
retinenda, Navicula, 118.
retrostauros, Navicula, 118, 180.
rex, Coscinodiscus, 66, 70.
Rhabdocidaris bispinosa, 258.
Rhabdonema, 9, 141.
  adriaticum, 141.
  arcuatum, 141.
  mirificum, 141.
  sutum, 141, 181.
Rhaphoneis, 61, 73, 142.
  amphiceros, 142.
  bilineata, 142.
  mammalis, 60–62.
Rhizoselenia, 2.
Rhizosolenia, 82, 142.
  hebetata, 142.
  setigera, 142.
Rhoicosigma, 74, 131, 132, 142.
  compactum, 143.
  oceanicum, 143.
  robustum, 143.
  weissflogii, 143.
rhombeum, Pleurosigma, 138.
rhombica, Amphora, 27.
  Navicula, 119.
rhomboides, Frustulia, 147.
rhombus, Mastogloia, 8, 91.
Rhopalocidaris, 272, 273.
  hirsutispina, 275.
  hirsutispina viridis, 243, 273, 274 (fig.), 308, 310, 311.
richardsoniana, Navicula, 109.
richi, Obba mesai, 357, 358.
rigens, Pleurosigma, 138, 181.
rigidum, Pleurosigma, 138.
rimosa, Hydrosilicon, 85.
rivalis, Campylodiscus, 55.
rizalana, Obba marmorata, 338, 340.
robertsiana, Biddulphia, 45.
robertsianus, Campylodiscus, 51, 55.
robusta, Cocconeis, 62.
  Cochlostyla (Chrysallis) albolabris, 493.
  Navicula, 119.
  Plagiogramma gregorianum, 130.
  Stauroneis, 112.
  Stephanopyxis, 84, 92, 93.
  Synedra, 160.
robustum, Pleurosigma, 136.
  Rhoicosigma, 143.
robustus, Asteromphalus, 30.
  Coscinodiscus, 67.
roissyana, Cochlostyla, 389, 394, 397, 398.
  Cochlostyla (Calocochlea), 381, 386, 391.

roissyana, Cochlostyla (Calocochlea) roissyana, 387, 393.
    Helicostyla, 393, 394.
    Helicostyla (Calocochlea), 394.
    Helix, 389, 393, 394, 397.
    Helix (Callicochlias), 394.
roissyana var., Cochlostyla, 397.
    var., Helix, 391.
    var. c, Cochlostyla, 391.
    var. d, Cochlostyla, 397.
    var. d, Helix, 389.
    var. e, Cochlostyla, 396.
    var. m, Cochlostyla, 391.
    var. q, Cochlostyla, 398.
rollei, Cochlostyla, 489, 493.
    Cochlostyla (Chrysallis), 487, 488, 502, 504.
    Cochlostyla (Chrysallis) rollei, 488.
    Helicostyla (Chrysallis), 488.
Roperia, 143, 146.
    tessellata, 143, 181.
roperiana, Biddulphia, 45.
roperianus, Asteromphalus, 30.
rosea, Cochlostyla (Chrysallis) roseolabra, 497–499.
roseolabra, Cochlostyla (Chrysallis), 497.
    Cochlostyla (Chrysallis) roseolabra, 497.
rotula, Actinocyclus, 13.
rotundus, Cerataulus, 37.
rubida, Stylocidaris reini, 293, 295, 308, 310.
rubra, Stereocidaris grandis, 301, 309.
rudis, Biddulphia, 45, 177.
rufa, Campanularia, 210, 211.
    Zygophylax, 199, 210.
rufogaster, Bulimus, 331, 334, 335.
    Cochlostyla, 329–337.
    Cochlostyla rufogaster, 331, 334.
    Helix (Bulima), 334.
    Orthostyla, 334, 335.
    Orthostylus, 334.
rufogaster subsp., Cochlostyla, 337.
rufogastra, Bulimus, 335.
    Cochlostyla, 330, 333, 335.
    Helicostyla, 335.
Rutilaria, 143, 144.
    epsilon, 144.
    philippinarum, 143.
    pulchra, 143.
    radiata, 144.
    tenuicornis, 144.
Sabellariidae, 190.
sablayana, Obba mesai, 357, 358.
salcedoi, Obba planulata, 361, 364.
salinarum, Nitzschia, 128.
samoensis, Campylodiscus, 50, 52, 55.
    Navicula, 119.
sansibarica, Mastogloia, 91, 92.
sapolana, Cochlostyla (Helicostyla) fulgens, 400, 404.
sarcinosa, Cochlostyla (Helicobulinus), 433.
sarcochroa, Obba, 343.
    Obba sarcochroa, 356.
sarniensis, Amphora, 28.
scabriuscula, Amphora, 22.
scalaris, Amphora, 26.
    Campylodiscus, 54.
    Obba listeri, 351, 353.
Scalpellum, 299.
sceptrifera, Stereocidaris, 292.
sceptriferoides, Stereocidaris, 306.
Sceptroneis, 144.
    cuneata, 144, 159, 181.
Schizocidaris, 275, 276, 282.
    assimilis, 276, 279, 280.
    fasciata, 243, 276, 280, 281 (fig.), 308, 310, 311.
    serrata, 243, 276, 278–279 (fig.), 308, 310, 311.
schleinitzii, Actinodiscus, 13.
    Polymyxus, 14.
    Surirella, 49, 156, 157.
schmidtii, Amphora, 8, 27.
    Auliscus, 33.
    Biddulphia, 46.
    Campylodiscus, 54.
Schmitt, W. L., 183.
schneideri, Scoliopleura, 90.
Schuettia, 14.
scimiter, Climacosphenia, 59, 177.
scintillans, Coscinodiscus, 64.
scitula, Biddulphia, 8, 39, 46.
    Biddulphia (Triceratium), 35.
scitulum, Biddulphia (Triceratium), 38.
    Triceratium, 39, 46.
scitulus, Coscinodiscus, 70, 178.
Scoliopleura, 59, 71, 90, 94, 144.
    latestriata, 144.
    partistriata, 144, 181.
    peisonis, 90.
    schneideri, 90.
    thumi, 144.
    tumida, 89.
Scoliotropis, 144.
    tumida, 144.
scolopendra, Chaetoceros, 57.
scopulorum, Navicula, 147, 148.
    Okedenia, 148.
sculptum, Trigonium, 170, 171.
scutellum, Cocconeis, 62.
Secallia, 80, 144.
    caballeroi, 81, 144, 178.
secedens, Biddulphia, 46.
secunda, Aglaophenia (Lytocarpia), 234.
secundus, Lytocarpus, 234.
seductilis, Navicula, 119.
sejuncta, Navicula, 117.
semistauros, Navicula, 119, 180.
Semper, Carl, 375.
separabilis, Navicula, 8, 99, 120.
seriata, Mastogloia, 92.
serpentina, Grammatophora, 79.
serrata, Discocidaris, 276.
    Schizocidaris, 243, 276, 278–279 (fig.), 308, 310, 311.
serratula, Navicula, 120, 180.
serrulata, Navicula, 7.
    Obelia, 202.
Sertaria, 198.
Sertomminae, 196.
Sertularella, 197, 204, 214, 221.
    cornuta, 195, 199, 215, 216, 241.
    mirabilis, 199, 216, 241.

Sertularella philippinensis, 199, 217.
  polyzonias, 216.
  polyzonias cornuta, 215.
Sertularia, 196.
  digitalis, 218.
  divergens, 199, 213.
  dubia, 213.
  minuta, 213.
  pennaria, 234.
  quadridentata, 220.
  tenuis, 213.
  tubitheca, 221.
Sertularidae, 196, 199, 213.
Sertularinae, 196.
sessile, Halecium, 202.
setigera, Biddulphia, 46.
  Rhizosolenia, 142.
setosa, Melosira, 92.
shadboltianum, Triceratium, 40.
sibolonensis, Cochlostyla (Cochlodryas) mateoi, 422, 425.
  Obba listeri, 345, 346.
signa, Cochlostyla (Cochlodryas) florida, 411, 414.
significans, Surirella, 158, 182.
sima, Amphora, 27, 176.
simile, Pleurosigma, 138.
similis, Campylodiscus, 158.
simplex, Bulimus, 449, 450.
  Cochlostyla, 450.
  Cochlostyla (Eudoxus), 449, 453.
  Eudoxus, 449.
  Helicostyla, 450.
  Phengus, 450.
  Stictodiscus, 150.
simulator, Navicula, 120, 180.
sinuata, Amphora, 28.
  Mastogloia, 91, 92.
Skeletonema, 92, 94, 145, 161.
  barbadense, 145.
  costatum, 145.
  mediterraneanum, 145.
  mirabile, 145.
smithi, Obba listeri, 345, 351.
smithii, Cerataulus, 44.
  Navicula, 106, 121.
sociale, Chaetoceros, 57.
solaris, Navicula, 111.
solida, Cochlostyla roissyana, 398.
  Helix, 398.
solidus, Bulimus, 398.
Solium, 172.
sparsus, Actinocyclus, 12, 13.
sparsus-punctata, Aulacodiscus oregonus, 31.
spathulata, Nitzschia, 128.
  Podocystis, 140.
spathulatum, Euphyllodium, 140.
speciosum, Pleurosigma, 139.
spectabilis, Amphora, 21, 23.
  Lytocarpus, 199, 234.
  Navicula, 107, 121, 180.
spectabilsi, Amphora, 6.
spendidus, Coscinodiscus, 66.
Sphinctocystis, 9.
spiculifera, Navicula, 121, 180.
spinosum, Triceratium, 46.
spinulosa, Biddulphia, 46.
spiralis, Hebella, 198, 208, 241.
splendens, Actinocyclus, 13.
  Actinoptychus, 15.
splendida, Mastogloia, 92.
  Navicula, 98, 117, 122.
splendida var., Navicula, 7.
squamosa, Mastogloia, 92.
Stauroneis, 95, 112, 113.
  apiculata, 61.
  obesa, 62, 111.
  robusta, 112.
staurophora, Denticula, 130.
stauroptera, Navicula (Pseudo-Amphiprora), 96.
Steatodryas (subg.), 430.
Steatodryas cepoides, 432.
Stechowia, 196, 230.
  armata, 199, 230, 242.
Steere, J. B., 375.
steerei, Cochlostyla (Eudoxus), 451.
Stegopoma dimorpha, 198, 206, 241.
  fasciata, 206.
  fastigiata, 205.
  gilberti, 207.
  gracilis, 198, 205.
  medusiformis, 205, 206.
  plicatile, 195, 198, 204.
stelliger, Hyalodiscus, 85.
Stephanocidaris bispinosa, 259.
  glandulosa, 256.
Stephanopyxis, 75, 76, 92, 93, 145, 161.
(Stephanopyxis) Pyxidicula, 76.
Stephanopyxis aculeata, 145.
  appendiculata, 145.
  brunii, 145.
  robusta, 84, 92, 93.
  turris, 145.
  turris arctica inermis, 93.
Stereocidaris, 299.
  grandis, 299, 301, 309.
  grandis rubra, 301, 309.
  indica, 303.
  microtuberculata, 300, 302, 309.
  sceptrifera, 292.
  sceptriferoides, 306.
  sceptriferoides lamellata, 304, 305 (fig.), 309, 310, 311.
Stictocyclus, 13, 146.
  varicus, 146, 181.
Stictodesmis, 147, 148.
  australis, 147.
stictodiscus, Actinocyclus, 13, 146.
Stictodiscus, 29, 146, 149, 150, 162, 163, 165, 168.
  affinis, 149.
  anceps, 166.
  argus, 149.
  bicoronatum, 167.
  bicoronatus, 166–168.
  californicus, 149, 150, 163, 181.
  eulensteinii, 149, 166.
  japonicus, 149.
  johnsonianus, 162.
  kittonianus, 149.
  kossuthii, 29.
  multifurcatus, 149.
  multiplex, 149, 166.
  nankoorensis, 149.

Stictodiscus nitidus, 150, 181.
    parallelus, 150.
    parallelus gibbosa, 150.
    radfordianus, 150, 166, 167.
    radiatus, 150.
    simplex, 150.
    varians, 150.
stockhardtii, Auliscus, 33.
stokesiana, Biddulphia, 46.
Stoschia, 150.
    admirabilis, 70, 150, 151.
strangulata, Navicula, 100, 123.
striata, Cyclotella, 71.
strigosum, Pleurosigma, 139.
studeri, Surirella, 154, 158, 182.
Stylifer, 291.
Stylocidaris, 285, 291, 299.
    annulosa, 294 (fig.), 296, 298 (fig.), 308–310, 312.
    bracteata, 258.
    effluens, 285, 290 (fig.), 292, 294, 308–310, 312.
    reini, 292, 294 (fig.), 299, 309.
    reini cladothrix, 293, 294 (fig.), 296, 309, 310.
    reini rubida, 293, 295, 308, 310.
    tiara, 292.
Stylodon dolium, 431.
Stylodonta dolium, 431.
subacuta, Navicula, 122.
subangulatus, Actinoptychus, 15.
subatra, Cochlostyla (Calocochlea), 393.
    Cochlostyla roissyana, 389.
    Cochlostyla (Calocochlea) roissyana, 387, 389.
    Helicostyla roissyana, 389.
subconstricta, Nitzschia marginulata, 8, 127.
subhorizontalis, Obba, 343, 355.
    Obba subhorizontalis, 355.
suboscitans, Navicula, 112, 122.
    Navicula oscitans, 112.
subpallida, Cochlostyla (Prochilus) cuyoensis, 465, 466.
subplanulata, Obba listeri, 345, 353, 354.
subrigidum, Pleurosigma, 139.
subrufa, Campanularia, 211.
subscalaris, Obbina listeri recurvata, 351, 353.
subsessilis, Achnanthes, 11.
subspinosa, Biddulphia reticulata, 45.
substauroneiformis, Navicula approximata, 7, 94.
substauroniformis, Navicula approximata, 7.
subtilis, Actinocyclus, 13.
    Coscinodiscus, 70.
    Hyalodiscus, 12, 84, 85.
subundulata, Navicula (oscitans var.?), 122.
subvelatus, Coscinodiscus, 68.
sufflata, Cymatoneis, 72, 178.
suffocata, Navicula, 122, 180.
sulcata, Cymatoneis, 8, 71, 73, 122.
    Navicula, 122.
sulcatum, Plagiogramma, 131.
suluense, Pleurosigma, 139, 181.
suluensis, Surirella, 158, 182.
sumbawana, Surirella, 151.
superba, Nitzschia, 126, 128.
Surirella, 70, 151, 155, 156.
    apiac, 155.
    bertillonii, 151, 181.
    castracanei, 151.
    ceylanensis, 151, 154, 157.
    ceylanensis oblongistriata, 151.
    comis, 152.
    concentrica, 152, 181.
    contigua, 152, 181.
    continuata, 153, 181.
    craticula, 147.
    cuneata, 153.
    cuneatella, 153, 181.
    curvifacies, 154.
    deflexa, 154, 156.
    facilis, 154, 182.
    fastuosa, 7, 153–156, 159.
    fausta, 155, 182.
    fluminensis, 7, 155.
    foliata, 152, 181.
    gemma, 152.
    grandiuscula, 155.
    gravis, 155, 181.
    hybrida, 155.
    imitans, 155, 181.
    incurvata, 154, 156.
    intercedens, 156.
    japonica, 157.
    lata, 156, 157.
    lata macraeana, 157.
    laxa, 156.
    macraeana, 154, 156, 157, 181, 182.
    mexicana, 157.
    mollis, 156, 158.
    multicostata, 151.
    orientalis, 156, 182.
    pacifica, 157.
    patens, 157.
    recedens, 157.
    reniformis, 70, 151, 157.
    schleinitzii, 49, 156, 157.
    significans, 158, 182.
    studeri, 154, 158, 182.
    suluensis, 158, 182.
    sumbawana, 151.
    tahitiana, 159.
    trauensteinii, 154.
    tridens, 153.
sutum, Rhabdonema, 141, 181.
sylvanoides, Cochlostyla, 456, 459.
    Cochlostyla virgata, 457.
    Helicostyla virgata, 457.
sylvanus, Bulimus, 456, 487.
    Bulinus, 455, 458.
    Cochlostyla (Prochilus), 460.
symmetricus, Coscinodiscus, 70.
Syndendrium diadema, 159.
Synedra, 140, 144, 159.
    crystallina, 159.
    cuneata, 159.
    formosa, 160.
    fulgens, 159.
    pulcherrima, 159, 182.
    robusta, 160.
    undulata, 160.
Synthecidae, 199, 221.

Synthecium flabellum, 221.
  tubithecum, 199, 221.
Syringidium, 160.
  americanum, 160.
  daemon, 160.
  diadema, 56.
tabellaria, Biddulphia, 46.
  Navicula, 94.
tabellarium, Biddulphia (Triceratium), 39.
taeniatus, Campylodiscus, 55.
Taeniogyrus cidaridis, 302.
tahitiana, Surirella, 159.
temperei, Amphiprora, 17.
  Biddulphia, 46.
tenarius, Actinoptychus, 15.
tenera, Cochlostyla, 422, 423, 426, 427.
  Cochlostyla (Cochlodryas), 423, 429.
  Helicostyla, 422, 423.
  Helix, 422, 423, 426, 427.
  Helix (Cochlogena), 422, 427.
tenuicornis, Rutilaria, 144.
tenuirostris, Halicornaria, 199, 237, 242.
tenuis, Sertularia, 213.
tenuispina, Goniocidaris (Cyrtocidaris), 264, 266 (fig.), 268 (fig.), 270, 285, 307, 308, 310, 311.
tenuistauros, Achnanthes, 11, 176.
Terpsinoe, 160.
  intermedia, 160.
  musica, 160.
terroris, Amphora, 21.
tesselatum, Plagiogramma, 77, 131.
Tessella, 9.
tessellata, Roperia, 143, 181.
tetragibba, Amphora, 28.
Thalassiothrix, 160.
  frauenfeldii, 160.
Thaumatonema, 161.
Thecocarpus, 236, 237.
  balei, 199, 236, 242.
thornelyi, Obelia, 198, 202.
Thuiaria, 196.
  elegans, 220.
  quadridens, 199, 214.
  quadrilateralis, 214.
thumi, Scoliopleura, 144.
thumii, Dictyoneis, 108.
  Navicula (Dictyoneis), 123.
thuringicum, Gyrosigma, 9.
Thyroscyphinae, 196.
Thyroscyphus, 203.
  marginatus, 198, 203.
tiara, Stylocidaris, 292.
titiana, Biddulphia, 170.
toppingi, Cochlostyla rufogaster, 336.
Toxonidia, 131, 142.
transfuga, Navicula, 116.
translucens, Navicula, 123, 180.
transversa, Cocconeis, 64.
transversale, Pleurosigma, 135.
trauensteinii, Surirella, 154.
Treadwell, Aaron L., on four new species of polychaetous annelids, 313.
  on polychaetous annelids, including one new genus and three new species, 183.
Tretocidaris reini, 292.
Tribrachia, 160.
  pellucida, 161, 182.
Triceratium, 42, 161, 162, 164, 168, 172, 173.
  annulatum, 14.
  areolatum, 40.
  armatum, 46.
  bicorne, 38.
  castelliferum, 48.
  cellulosum, 42.
  circulare, 40.
  concavum, 35.
  cornutum, 44.
  cornutum pulchella, 44.
  cyclamen, 34.
  dulce, 173.
  eulensteinii, 166, 167.
  eulensteinii inornata, 166, 167.
  expressum, 42.
  fimbriatum, 47.
  forresterii, 37.
  galapagense, 166–168.
  globosum, 40.
  grave, 46.
  heteroporum, 167.
  (Biddulphia) heteroporum, 166, 168.
  japonicum, 35.
  jensenianum, 40.
  lineolatum, 40.
  madagascarense, 42.
  marylandicum, 14.
  multiplex, 166, 167.
  neogradense, 14.
  partitum, 42.
  pauperculum, 173.
  petitianum, 43.
  portuosum, 166.
  pulchellum, 44.
  radio-punctatum, 42.
  robertsianum inermis, 47.
  scitulum, 39, 46.
  shadboltianum, 40.
  spinosum, 46.
  trigonium, 14.
  trisulcum, 47.
  turriferum, 47, 48.
  venulosum, 39, 46.
  venulosum diplosticta, 46.
tridens, Surirella, 153.
Tridentata, 196, 197, 198.
tridentata, Cerion, 455.
trigonium, Triceratium, 14.
Trigonium, 35, 81, 161, 162, 164, 168, 172.
  antarcticum, 164.
  arcticum, 34, 161, 164, 166, 169, 171.
  arctium, 161.
  balaena, 34, 161, 170.
  bicoronatum, 149, 161, 165, 169, 182.
  caelatum, 162.
  cinnamomeum, 8, 162.
  contumax, 162, 182.
  cyclamen, 161.
  diaphanum, 163, 169, 182.
  dissimile, 165, 170.

Trigonium dulce, 165.
  eulensteinii, 149, 161, 166–168, 170, 171.
  formosum, 164, 169.
  formosum var., 164.
  frauenfeldii, 169.
  geminum, 169.
  gibbosum, 169.
  heteroporum, 167, 169.
  inelegans, 169.
  inelegans micropora, 169.
  inglorium, 169.
  latum, 165, 169, 170, 171.
  margaritiferum, 162.
  membranaceum, 42, 170.
  multiplex, 167, 170.
  pardus, 170.
  plenum, 162.
  punctatum, 169–171.
  quinquelobatum, 171.
  radfordianum, 150, 171.
  (Triceratium) radiolatum, 171.
  reticulum, 171.
  sculptum, 170, 171.
  weissflogii, 162.
  zonulatum, 170, 171.
trilingulatus, Actinoptychus, 14, 15.
Trinacria, 172.
  limpida, 172, 182.
  regina, 172.
  tripedalis, 173, 182.
  wittii, 172.
tripedalis, Trinacria, 173, 182.
Tripodiscus, 9.
tripos, Biddulphia, 46.
triramosa, Aglaophenia, 199, 219, 232, 242.
trisinua, Biddulphia, 47, 177.
trisulcum, Triceratium, 47.
tritaeniata, Cochlostyla cincinniformis, 441.
triumphans, Campylodiscus, 7, 55.
Trochosira, 92.
Tropidoneis, 16, 59, 71, 173, 175.
  approximata, 173.
  fragilis, 173, 174.
  javanica, 173.
  lata, 174.
  lepidoptera, 174, 175.
  maxima, 174.
  membrànacea, 174.
  membrancacea, 173.
  oblonga, 174.
  phantasma, 174, 182.
  vaga, 174, 182.
truanii, Plagiogramma, 129.
tryblionella, Nitzschia, 128.
tuberculata, Goniocidaris (Cyrtocidaris) tenuispina, 268–270 (fig.), 271, 272, 307, 308, 310, 311.
tubicola, Nitzschia, 128.
tubiformis, Coscinodiscus, 70.
tubitheca, Sertularia, 221.
tubithecum, Synthecium, 199, 221.
Tubularidae, 198, 200.
tumescens, Biddulphia, 47.
  Nitzschia distans, 8, 126.
tumida, Navicula, 89.
tumida, Scoliopleura, 89.
  Scoliotropis, 144.
tumulifer, Amphora, 28, 176.
tuomeyi, Biddulphia, 47.
turbo, Bulimus (Orthostylus), 433.
  Cochlodryas, 433.
  Cochlostyla, 433, 434.
  Cochlostyla (Helicobulinus), 433.
  Cochlostyla (Rhymbocochlias), 434.
  Cochlostyla cinerascens, 433.
  Helicobulinus, 433.
  Helicostyla, 434.
  Helix, 433.
turgescens, Navicula, 123.
turgida, Amphora, 28.
  Biddulphia, 47.
turgidus, Cerataulus, 43, 44.
turriferum, Triceratium, 47, 48.
turrigera, Biddulphia, 47, 177.
turris, Stephanopyxis, 145.
turturinganus, Opisthoporus quadrasi, 325, 326.
ultima, Cochlostyla (Hypselostyla) cincinniformis, 436, 439.
  Cochlostyla (Hypselostylus) cincinniformis, 436.
  Helicostyla cincinniformis, 436.
umbraculum, Goniocidaris, 272, 273.
undulata, Melosira, 93.
  Synedra, 160.
undulatus, Actinoptychus, 14, 15.
undulosa, Biddulphia, 48, 177.
unitaeniata, Cochlostyla cincinniformis, 441.
United States Exploring Expedition, 375.
urens, Aglaophenia, 199, 232, 235.
ustulata, Chrysallis chrysalidiformis, 477.
  Cochlostyla, 470, 477.
  Helicostyla (Chrysallis), 479.
ustulatus, Bulimus, 476, 477.
  Cochlostyla chrysalidiformis, 477.
  Helicostyla chrysalidiformis, 477.
vacillans, Navicula, 124.
vaga, Tropidoneis, 174, 182.
valida, Nitzschia, 8, 128.
valida var., Nitzschia, 8.
validum, Plagiogramma, 77.
Van Heurckia, 10.
van huerckii, Asterolampra, 29.
  Plagiogramma, 41.
varaderoana, Cochlostyla (Cochlostyla) hydrophana, 408, 410.
  Obba planulata, 361, 363, 365.
varians, Bacteriastrum, 56, 57.
  Chaetoceros (Bacteriastrum), 58.
  Stictodiscus, 150.
varicus, Stictocyclus, 146, 181.
variolatus, Coscinodiscus, 8, 71, 178.
vaszaryi, Navicula, 12.
velata, Navicula, 124.
ventricosa, Achnanthes, 11.
ventricosus, Hemidiscus, 80.
venulosum, Triceratium, 39, 46.
venusta, Navicula, 124, 180.
verdensis, Obba planulata, 361, 362, 370.
vermiculata, Nitzschia, 128.
vermiculatus, Echinodiscus, 75, 178.

versicolor, Amphidromus, 500.
verticillata, Phyllacanthus, 260.
  Plococidaris, 260.
  Prionocidaris, 260.
vespa, Diploneis, 124.
  Navicula, 124.
vesparella, Navicula, 124, 180.
vexator, Cochlostyla (Chrysallis) rollei, 488–490.
viaregis, Cerion, 454.
villosa, Cochlostyla (Chrysallis) chrysalidiformis, 470, 473, 475.
virgata, Amphora, 24.
  Bulimus, 481.
  Cochlostyla, 456, 457.
  Cochlostyla (Prochilus), 454, 455, 457, 460, 462, 465.
  Helicostyla, 457.
  Helicostyla (Prochilus), 457.
  Prochilus, 456.
virgatus, Amphidromus, 456.
  Bulimus, 455, 456, 459.
  Bulimus (Amphidromus), 456.
  Bulinus, 455.
  Prochilus, 456.
virginea, Cochlostyla, 451, 452.
  Helicostyla, 451, 452.
  Helicostyla (Eudoxus), 452.
virginicum, Pleurosigma, 133.
virgo, Cochlostyla (Corasia) 380.
viridis, Rhopalocidaris hirsutispina, 243, 273, 274 (fig.), 308, 310, 311.
vitrea, Amphora ostrearia, 25.
Vivipara, 455.
vulpecula, Navicula, 124.
wagneri, Bulimus, 501, 512.
  Bulimus aspersus, 512.
wagneri, Chrysallis, 512.
  Cochlostyla, 512.
  Cochlostyla (Chrysallis) aspersa. 501, 503, 512.
  Cochlostyla mindoroensis, 501.
wallichianus, Campylodiscus, 55.
wallichii, Bacteriastrum, 57.
  Chaetoceros, 57.
weissflogii, Amphora, 28.
  Brebissonia, 119.
  Navicula, 8, 125, 180.
  Nitzschia, 7, 128, 180.
  Rhoicosigma, 143.
  Trigonium, 162.
Willemoesia, 175.
  elongata, 175.
  humilis, 175.
willemoesii, Onuphis (Nothria), 319.
williamsonii, Glyphodesmis, 77.
wittii, Trinacria, 172.
Wood, W. W., 374.
Worcester, Dean C., 373, 375, 376.
Xanthiopyxis, 145.
yarrensis, Navicula, 118, 125.
zebra, Epithemia, 16, 77.
zebuana, Nitzschia, 129, 180.
  Nitzschia plana, 129.
zebuanus, Campylodiscus, 49.
zonulatum, Trigonium, 170, 171.
zostereti, Navicula, 125.
Zygoceros radiatus, 161.
Zygophylax convallaria, 195, 199, 211.
  curvitheca, 196, 199, 212, 241.
  rufa, 199, 210.

47

SMITHSONIAN INSTITUTION LIBRARIES
3 9088 01421 1627